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ABSTRACT

Seven papers from the 1990 CAUSE conference's Track 1, Planning and Strategy, are presented. They discuss approaches to information technology strategies which are commensurate with an institution's mission and strategic directions. Papers and their authors are as follows: "Future Directions in Higher Education: A CIO's (Chief Information Officer) Perspective" (M. Lewis Temares); "Strategic Planning in a Non-Strategic Environment" (Joy R. Hughes); "The Biomedical Information Communication Center: Planning an Integrated Academic Information Management System" (Kathryn I. Pyle, Joan S. Ash, J. Robert Beck); "Reengineering: A Concept for Higher Education?" (James I. Penrod, Michael G. Dolence); "Transition Years for Information Technology - Planning in the Strategic Decade" (David J. Ernst); "Build or Buy Decision Variables - Perspectives from Three Institutions" (Len Brush, Alan W. Hartwig, Richard D. Sheeder); and "Bootstrapping a Small Campus into the Electronic Age" (Richard L. Kimball). References accompany most papers. (GLR)

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CAUSE

Challenges and Opportunities of Information Technology in the 90s

Proceedings of the
1990 CAUSE National Conference

TRACK I

PLANNING AND STRATEGY

November 27 - 30, 1990
Fontainebleau Hilton Resort and Spa
Miami Beach, Florida

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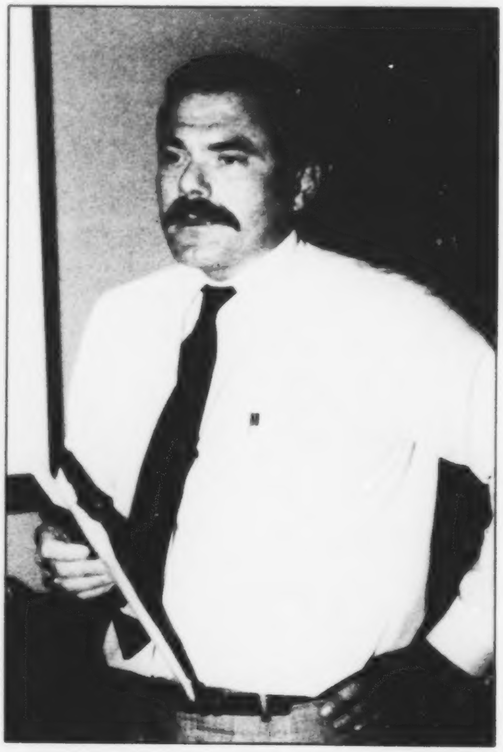
TRACK I

PLANNING AND STRATEGY

Coordinator: Ronald L. Moore, University of Louisville

Institutions of higher education depend on an information infrastructure for their growth and prosperity. The acquisition, development, and implementation of technology must be directed by and encompass the overall mission and strategic emphasis of the institution. Papers in this track discuss approaches to information technology strategies which are commensurate with an institution's mission and strategic directions.



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CAUSE '90

Future Directions In Higher Education: A CIO's Perspective

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ABSTRACT

The future directions for an Information Systems department in higher education has little foundation in the past. As Paul Valery noted, "The Future... Isn't What It Used To Be." External sources such as "Megatrends," Fortune magazine, Index Group and MIS Quarterly have discussed the key issues of the 90s. However, how these results can be related to higher education and its uniqueness is never discussed. This paper will begin with the issues as stated in the corporate environment, look at the issues affecting higher education and relate both to the role information systems and information technology can and should play for future growth. The I/T executive in the academic world must remember who his customers are, who pays his/her salary and to whom he/she must be accountable. The key management issues of role change, organization, fiduciary responsibility and image for the department and the leaders of I/T on the campus will be addressed from the CIO's perspective.

"In Times Of Turbulence The Ability To Anticipate Enhances Dramatically Your Chances For Success." Peter Drucker

INTRODUCTION

The Information Systems department in higher education is looking towards an exciting future--a collision with tomorrow. Tomorrow is not going to look very much like yesterday; it is not going to look very much like today for the higher education institution or for the Information Systems department within the higher education institution. The purpose of this paper is to challenge the reader to recognize and question changes which will assist a person in the Information Systems department to anticipate the future.

FUTURE TRENDS

The trends occurring around us in the universe all affect how we should be looking at the Information Systems department's role in a university or in a business during the decade of the 90's. We must look at global trends, megatrends, market place trends, management trends and work place trends. We must examine the issues of concern to various C.E.O's and other leaders of the society. This will allow us to look at the higher education issues of the 90's from more than a parochial point of view. A C.I.O's perspective of future directions in higher education has to address the external aspects, the internal aspects, including his organization, and most of all the changes that are occurring. Coping with change is the most challenging of the 90's issues. Our goal should be to affect the future, not merely accept the future.

A. Global Trends

We are entering a time when the "global village" is going to be realized. We have a series of recovered dominant economies, especially Japan and Germany, the unified Germany; we have new industrialized countries, Korea, Taiwan, Singapore; we have a shift in the economic environment in Eastern Europe, Russia and maybe China; and, certainly, we have a whole new power structure with the European community of 1992 and the Pacific Rim Countries. There is an aging work force. There will be the economic triad of Europe, the Pacific Rim and the Americas, North and South; there will be strategic alliances that will come up necessitating newly formed relationships; there is a shortage of critical skills; there will be a looking at the environmental impacts of decisions; views will change from gross profit to market share analysis; a global competition will be an aspect to be examined seriously by all organizations, whether in higher education or in the corporate world. Except for the middle east crisis, generally there will be a war to peace paradigm and throughout the world it looks like there will be a shift in values. Examples of the above are in the newspaper on an everyday basis. Most universities are looking, for example, towards international education for their students. The University of Miami has arrangements with forty three (43) institutions in seventeen (17) countries all the way from Argentina to Vietnam.

In their book "Megatrends", Naisbitt and Aurenberg list the ten (10) megatrends of the year 2000. They, too, list the Pacific Rim as where the future lies; that there is going to be a move toward world wide free trade, that an information-based economy is a high wage economy. Included in their listing are some important and interesting items such as English emerging as the first universal language. They expect a period of economic good times and expansion; there is a dual direction of globalization and nationalization; cities will decline and the quality of life rural areas will emerge significant. Although the information based economy is important in the future and the directions of change will be driven by it, the big story will not be in technology, but with the renaissance in arts, literature and spirituality. This has an affect in higher education because the students will be a different kind of student, more like the 60's rather than the 80's. Alvin Toffler, in his most recent book "Power Shift," says "The most important power shift of all is not from one person, party, institution, or nation to another. It is the hidden shift in the relationships between violence, wealth and knowledge as society speeds toward their collision with tomorrow. The growth of knowledge as a power is a force to be reckoned with in the 90's."

B. Marketplace Trends

In the marketplace, whether in higher education or in industry, there will be a customer obsession. We will look towards electronic data interchange as a productivity tool. The demassification predicted in the early 80's book by Toffler, "The Third Wave," will become more real with the variety of products customized to meet the consumer demands. More efforts will be expended to compete in time, with time being utilized as a significant variable. Lastly, more electronic marketing will be accomplished whether through systems such as "Prodigy" or the home shopping network, or microcomputers in the household through modems connected to consumer networks. All of these will result in changes in the information society that will have to be addressed by the C.I.O. In higher education the customer obsession, the student obsession, the faculty member obsession and the administrator obsession will make customer satisfaction programs and total quality improvement programs commonplace rather than the exception.

C. Management Trends

The 90's will also see a change in the way we manage people. We will go from the czarist or "General" approach to the coach approach. Organizations which were previously strictly hierarchical will become more network oriented and the demassification will be utilized as a methodology for organizational structure as well. Power to the people, with the people at the lower echelon being able to act as decision makers will be tested and proven to be moderately successful. Another trend would be towards aligning information technology with the goals of the organization, utilizing such things as decision support systems and executive information systems at the levels of management that they are appropriate. Expectations for every president of every university or corporation to be equipped and desirous enough to hit a terminal or a computer on a regular basis to seek his information rather than call a staff member, will still remain ill founded. The role of the Senior Information Technology Executive, whether called a C.I.O. or something else, will change to become more important in the organization in regard to planning and the setting of directions. The role of the C.I.O. will have staff as well as line functions, with the distribution of those functions dependant upon the organization and the method of leadership of the senior executives.

D. Work Place Trends

As noted previously, in the work place we will have empowered people with participatory management at all levels of the organization. More and more the front end person, the person of first contact, will have greater information and ability to solve problems. There will be work teams developing what we will call groupware, meeting the needs of a variety of subsets across organizational lines. There will be greater efforts to have people work at home on a full time and part time basis so that they can dial up through some technology to access the databases needed for them to perform their functions. Because of health care costs rising at such a rapid rate, there will be a greater tendency towards part time employees or outsourcing of functions in order to overcome the overhead costs of providing health care insurance. There will be a growth in work station power along with ease of use of software, so the knowledge worker can perform more on a simplistic basis. The ease of the use of the work stations and the ease of utilizing databases are extremely important because to find the trained workers needed in the year 2000's workplace will be difficult. In addition to the above trends, there will be a review of the loyalty of firms to employees and employees to firms and the anxieties caused by this lack of loyalty of the 80's. The reduction of middle management and seemingly removal of layers of organization without preparation, has caused both the loyalty level to go down and the anxiety level to go up with people anticipating work in the same organization from their inception into the work force to their retirement. No longer will this be a common practice in the workplace. Lastly, for productivity reasons, along with logical reasons, less automation of current entities will take place, but more re-engineering of the work will take place. As Mike Hammer has been quoted with regard to re-engineering work, "It is time to stop paving the cow paths. Instead of embedding outdated processes in silicone and software, we should obliterate them, and start over." We must change the way we do business.

FURTHER ISSUES OF CONCERN

A. Issues Of Concern To C.E.O's

A 1990 survey of C.E.O's in Fortune Magazine listed their major concerns to be cost containment, productivity, training and motivating employees, new product development, government regulations, and global competition. The significance of the survey is that the first three items are far and away the most important to C.E.O's. Index Group, Inc. had a comparison of the key issues in 1990 as compared to 1989 for 243 U. S. and Canadian executives. The listing is shown in table 1 below. The significance there is that the #11 item in 1989, "Reshaping business processes through information technology" has become the #1 item, while the #1 item of 1989, "Using information systems for competitive breakthroughs" has now dropped to the #8 position. Both surveys, you will notice, are looking for the reshaping of business processes. They place great emphasis on cost containment, productivity, and training and motivating employees, in order to create an organization poised and ready with the least fat for the year 2000. These executives looked at education and the alignment of information technology goals as important functions as well and certainly realize implementation of information technology is an important consideration for the year 2000 for the goals to be achieved.

B. Higher Education Issues Of The 90's

The Winter, 1990, "Educational Record," contained a listing from University/College Presidents' perspective of the most significant future issues confronting higher education. The analysis was divided into all institutions, public institutions, and private institutions. Far and away the number one issue was maintaining a proper level of funding. The interesting part occurs when you examine how the distribution occurred with regard to the other items of concern mentioned. That can be found in table 2 below and depending on what kind of institution you are associated with, this should be indicative as to the important issues as viewed by your President and his counterparts. In comparison with the previous Fortune Magazine study, managing the costs of higher education which one would consider to be similar to cost containment, is low at public institutions, but yet high with C.E.O's and medium to high with private institutions. Higher education seems to be lagging once again with regard to the important issues of the next decade. A paper could probably be written on the differences between the responses of the presidents and the responses of the C.E.O's in terms of how they view what the future will hold.

TABLE 1

1990 KEY ISSUES....INDEX GROUP INC. RANKINGS

1990		1989
1	Reshaping business processes through information technology	11
2	Educating senior management on information systems	3
3	Instituting cross-functional IS	7
4	Aligning IS and corporate goals	2
5	IS strategic planning	4
6	Boosting software development productivity	13
7	Utilizing data	6
8	Using IS for competitive breakthroughs	1
9	Developing an information architecture	5
10	Cutting IS costs	14

243 U. S. Canadian Executives

TABLE 2

The Most Significant Future Issues Confronting Higher Education

	Percentages of Respondents Who Ranked Item as Extremely or Very Important		
Item	**All Institutions**	**All Public Institutions**	**All Private Institutions**
Maintaining a proper level of funding.	93%	95%	91%
Maintaining a proper level of financial aid.	87%	79%	92%
Attracting and retaining qualified faculty members.	84%	88%	81%
Recruiting racial and ethnic minority students.	80%	84%	77%
Recruiting and retaining racial and ethnic minority faculty.	79%	88%	73%
Ensuring the quality of academic programs.	78%	73%	82%
Managing the costs of higher education.	77%	70%	83%
Assuring access of students from diverse socioeconomic statuses.	77%	79%	76%

(Percentages rounded to the nearest whole number.)

Educational Record *Winter 1990*

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Beyond what the presidents say as their issues facing higher education, other issues exist. Tuition, and its absolute and percentage increases that have been occurring, the quality of the undergraduate experience, the costs of the academic program delivery, the achievement of revenues and the costs of administrative and academic services are all of concern to politicians, academicians and parents. As everyone is aware who reads any newspapers, tuition has been increasing in the past decade on an absolute and percentage basis far beyond what would be expected by the consumer price index. This cannot continue at that level and places such as Stanford University, the University of Miami and other institutions are already announcing cutbacks of their tuition rates. However, the absolute tuition continues to go up both at private and public institutions.

With regard to the quality of the undergraduate experience, it is intriguing that although we measure entrance quality of the students using SAT scores, there is no measurement as to the value of education received by the student with an exiting test. The quality of the undergraduate experience is subjective and measured by the undergraduate institution, rather than by an objective outside measure. If we think it is important enough to have an objective outside measure of the quality of the students as an input, it seems strange there is no objective measure of the quality on the output side. If the student comes into an institution with a 1500 SAT and he graduates with a 1500 SAT, what value was added by the institution? Would it not be more impressive if a student came in with a 1000 SAT and graduated with a 1500 SAT? Our measurements of the quality and the value of the higher education experience need to be reanalyzed.

With cost containment being a big and hot issue in the corporate environment, obviously the academic environment is going to follow suit. The cost of academic program delivery by delivering a product the same way as it has been done over the last 300 years, and the cost of all the services provided along with the manner in which they are provided, have to be reviewed. Those institutions doing these services better at less of a cost or more productively, are the universities that are going to succeed in the year 2000. Cost containment becomes a primary concern when the revenues to the institutions are decreasing on a percentage basis. Government allocations for research and student aid are not growing in the same proportion as the costs. Tuition, as mentioned above, cannot grow at the same rate as it has been. Thus the combination of seeking new areas of revenue and reducing costs are prevalent issues for higher education in the 1990's. We cannot continue to do business the same way we have been doing business for the past three hundred (300) years. The university solving the problem of delivering its services at a lower cost per student will survive the 90's. The institution which finds a way to increase its productivity and still maintain the quality of its educational program will be the leader of the 21st century.

For each institution, an interested insider will view its problems in a more parochial vein. The role of teaching vs. research depends on the institution and its mission. The fight between Political Correctness and the National Association of Scholars can become an overriding issue and be divisive on the campus. The distribution of the decreased budgets, while meeting increased demands, requires leaders of solomonistic proportion. Reallocation of resources with a view toward the year 2000 has to be accomplished on a step by step basis. In addition, more interdisciplinary courses have to be offered to students who, as was mentioned before, are now more like the students of the 60's than the 80's, interested in environmental and social issues more than specific sectionalized issues. Thus, in conclusion, the 90's hot buttons to be encountered successfully in order for us to survive as institutions in the year 2000 are (1) the demand for more with less, (2) the obsession with the customer, (3) the implementation of the avalanche of technology, (4) the competition in time, and (5) the diversity of cultures and how they can be integrated through an interdependent independence.

MANAGING INFORMATION TECHNOLOGY IN THE 90'S

The most exciting issue of the 90's for executives is the management of change. Information technology's role in the management of change will determine the success and failure of a particular organization. Change can occur either by erosion or explosion. There are advantages to each. In terms of erosion, since waking up an organization leads everyone in the organization to hate or resist you, making gradual and small increments of change can prove successful. Little bits and little bites are very rarely noticed and change can take place because pretty soon a few bites add up to an entire meal. In addition, doing it on a slow and steady pace will allow the political environment to adapt to the change. One of the most common errors occurring in introducing change is to underestimate the political environment and not allow the informal organization to accept the alterations before the formal organization accepts it. There are advantages to the explosion methodology as well. If, in fact, the organization notices the bits and the bites, incremental change can build resistance. Thus, instead of working in favor of what you are trying to accomplish, it can actually work against you. For example, depending on the environment and depending on the availability of resources, the slow and steady introduction of electronic mail with those that are already on the network, can often lead to the acceptance of electronic mail. In some institutions without forcing everybody on electronic mail all at once and making it the only methodology for internal communication, electronic mail would never be accomplished. Thus, both methods can work but they are strictly dependent on the institution and its political environment.

The role of information technology is changing within organizations. The particular business functional unit is gaining increased responsibility for information technology, in order for it to produce what it feels necessary to do its job in a more timely manner. The scope of information technology is being extended beyond the enterprise using electronic data interchange and no longer is viewed as an island within the current organization. In addition, its role is changing because people see information technology as a support mechanism for gaining comparative advantage. Utilizing computer systems and software so databases can be accessed and kept up to date are necessary to maintain competitiveness. The accuracy of the data and the administration of the databases is of vital concern.

Human resource availability is another concern. Quality and quantity are questionable. The U.S. population growth is flat and any growth of workforce will come from immigration. In terms of the student body, the major growth will occur in the minorities. The number of 22 to 25 year olds as well as the U.S. median age is showing a down trend. More people left the labor force than entered it, within the past 5 years. Two to three percent fewer students graduated from college in 1990 than in 1985, leaving less people available to employ. There will be less quality brought forth from the educational marketplace. One out of five people entering the labor force from 1975 to 1985 did not have a high school education. In the last three years it has risen to one in every four. Corporations are viewing the lack of quality with alarm and spending their own money to educate in basic remedial courses, in addition to training. Estimates of $20 to $50 billion a year are being spent by U.S. businesses in remedial education. If you think about it, $50 billion was the net profit for the top 28 Fortune 500 companies in 1987.

We are looking at the 3 R's of staffing for the 1990's. The importance of recruiting, retraining and retaining cannot be underestimated. Recruiting has to become more competitive and the skills necessary for each job are constantly changing. Once you recruited the staff, you have to keep retraining them because changes are occurring on a daily basis and even techies need to learn how to become, to some degree, managers, and managers have to become techies to some degree. The cost of hiring somebody new very often is overlooked by not trying to save somebody who may be performing adequately. We have a tendency to seek perfection rather than to seek competence and the cost of retaining and retraining is far less than the cost of recruiting somebody for a particular position. The use of rewards such as financial fringe benefits, family benefits, and general pleasantness of the work place have a productivity value.

As noted before, along with the flattening of the organization or the demassification of the organization, there is a change with regard to the restructuring of the information technology organization. The information technology executive has to become more of a member of the policy team and involved in the planning for the 21st century. With increased focus on policy goes increased focus on strategy, planning and marketing as well as involving the functional managers in information technology decisions. The Senior Information Technology Executive must have greater vision insights, realizing services must be delivered any time, any place and to anyone in a mass customizing manner. The executive must shift her/his power base from owning to influencing with her/his ownership only of the critical shared resources. In conjunction with others, the C.I.O. can set policy and strategies, but the functional manager will have increased responsibilities. The Senior Information Technology Executive or C.I.O. must be market and customer driven, must change from building a technology (hardware/software) base to implementing with the current technology. Vision setting, management of change, making application of technology transparent and reducing the work force of the I.T. organization and the overall organization have to become goals. The C.I.O's reason for being is to provide vision and to reduce the time and numbers of decisions in process. One of the greatest losses in productivity, especially in higher education, is having many decisions in process rather than completed.

Realizing cost is a significant factor, especially cost of technology, there must be a financial strategy examining tangible and intangible benefits and looking at technology as an asset to the business rather than an expense. To do this, the financial strategy should be designed to modify behavior with its pricing critical to marketing. There should be a cost and price differential in order to create a reserve for information technology capitalization in the future. A strategy must be developed in concert with the functional managers. The managers must be empowered to do their job in a better way and this will allow them to make the business case for the growth in information technology. The greatest asset the Senior Information Technology Executive has when asking for increased resources is having the functional managers present the case.

The image of the Senior Information Technology Executive has to change. He/she has to go from the past czarism to become an influencer. He/she has to show results, not just activities. He/she has to be customer driven, rather than user driven. He/she has to have passion and understanding rather than merely intellect and technology. He/she must be more humble instead of arrogant, innovative rather than incremental and must look at things in terms of implementing rather than just planning. He/she must empower rather than control the customers.

There is an accountability function everyone in higher education has to address with regard to their particular functional role. Why your job exists and what you are paid to accomplish are things that should be paramount in your mind at all times. To be accountable you have to challenge the status quo, do at least as much with less, achieve your successes through others, make sure the information technologies align with the educational goals of the institution and every so often, once a week or once a month, you must take a position-even if it means gambling your job. We must remember, we are in the education business, the service business and the information business. What we have to do is to look back to see the future. Do you remember when the customer was always right, you realized that if you didn't try you lost, well begun was half done, honesty was the best policy, you treated others as you wished them to treat you, you could catch more flies with sugar than with salt and if you couldn't say anything nice about a person, you didn't say anything at all? We, in the education business, sometimes act like we are the least educated. Our reason for being is to add value to the university. Value is obtained by improving the academic, research and administrative performance of others. How much of what we do that is utilized in improving the quality of students, instruction and research is our value measurement.

To survive the 90's we have to change and along with this changing we have to reengineer our business. A new combative and visionary form of management aimed at improved productivity, quality, flexibility and customer focus is now the only way for a university to survive the 90's. We must change the way we do business.

Strategic Planning in a Non-Strategic Environment

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ABSTRACT

The accepted wisdom concerning planning for information systems is that such plans need to be tied to the institution's strategic goals. This assumes that the institution has strategic goals. Suppose the institution is in a state of transition, unsure of its mission, and/or not yet thinking strategically? Is it possible for the information services department to plan strategically in such an environment?

This paper is a case study of the efforts of an IS committee to develop a strategic plan in an institution that was in conflict over its mission and lacked explicit strategic goals. The IS committee first concentrated on uncovering the institution's core values and widely-held beliefs. It used these to make assumptions about the strategic directions the institution was likely to take once its mission was clarified. These efforts to identify the institution's implicit values played a major role in the success of the process. Other factors were the use of a structured planning model and the fact that as much attention was paid to the political aspects of planning as to the technological.

Description of the Non-strategic Environment

The university began as a small, church-related seminary one hundred years ago. It evolved into a church-related college, then an independent college, and finally into a university in 1979 when it added graduate programs. The school has fewer than 2000 students and about 60 full-time faculty, a quarter of whom hold the Ph.D. degree.

The school is relatively non-selective in its admissions policies, accepting most students who apply. It encourages those who do not meet the admissions criteria to attend for one semester as non-degree seeking students and then be reevaluated. These admissions policies create tension between the faculty who believe that the school admits students who lack the skills needed to succeed and the faculty whose overriding concern is declining enrollment.

The university began suffering a serious drop in enrollment in 1978. In response to the declining enrollment, it made significant efforts to attract part-time students. As a result, part-time enrollment has grown from about 20 percent to 52 percent of the total enrollment.

There is sharp disagreement on campus as to whether increasing the part-time enrollment has helped the institution since part-time students pay a per-credit rate that is only half of the per-credit rate paid by full-time students. Some people believe that the offering of associate degrees and certificate programs and the fact that the average age of the students is over twenty-five give the institution the feel of a community college. This may make the traditional students less willing to pay the more than $12,000 a year that it costs a residential student to attend. There is also disagreement on campus concerning whether the school deserves the appellation "university" and whether it ought to, or can really afford to, offer graduate programs.

The school has a very small endowment. This fact, plus the relatively low tuition when compared to other private schools, results in a budget deficit of about 1.5 million dollars a year. Most but not all of the deficit is made up by the community via an annual fund raising drive. The year after year inability of the institution to balance its budget, however, has caused a crisis in confidence in the community. As a result, donations have declined each year. The budget deficit also renders the institution ineligible for many foundation grants.

It was in this context that the regional accreditation association evaluated the university in late 1987. In addition to its concerns about the financial stability of the institution, the confusion over mission, and the proliferation of academic programs, the accreditation team expressed concern about the university's library. "The library," the team said, "is not adequate to serve the needs of your seniors and graduate students."

In response to the accreditation team's concern about the library, as well as other concerns about the library that had been raised by several constituencies on campus, the president decided to create a new organizational unit "information services" comprised of the library, telecommunications, and academic and administrative computing. I was asked to head the new unit and to develop a plan to improve library services. One month later the president left the university. An interim president who made it clear that he would not accept the permanent position was appointed.

My intention was to create a strategic plan for the library that would earn the support of the student body, the faculty, the administration, and the Board of the Trustees. But, I felt hampered by two constraints:

* the lack of stability in leadership; (All of the eight administrators who had interviewed me in 1986 had left the school. Some positions (Dean of Students, Dean of Admissions, Dean of Arts and Sciences, Director of Advancement) had turned over three times in three years, and the current president was only temporary.)

* the lack of an agreed-upon mission. (As the new president stated: "This lack of a mission is not for want of trying. It's because the university is factionalized, and each faction vehemently defends its idea of what the mission should be.")

In my studies of strategic planning for IS, I had noticed that most authors assume that the institution has a clearly defined mission and that the administration is relatively stable. They then frame the problem in terms of making sure that the plan for information systems is compatible with the mission of the institution and that it has the support of the administration. I was unable to find any advice as to what to do if the institution lacks a mission and the administration changes annually.

However, it was clear that any plan that was not strategic for the library was unlikely to succeed, given the severe financial straits of the university, the intensity and negativism of the various campus factions, and the loss of the president who had initiated the project. I decided to go ahead with the strategic planning process despite the lack of a strategic vision for the university as a whole, but to build into the planning model an effort to determine the core values of the university and the directions it was likely to take in the upcoming years.

Developing the Plan

The strategies used to develop the plan were based on those recommended by James Penrod at a CAUSE/EDUCOM workshop. They are designed to increase the probability that a plans's goals will be achieved. These strategies include: (1) gain legitimacy for the process before you put the plan together; (2) assemble a powerful planning team; (3) give the team responsibility for determining the strategic decision areas, identifying strengths and weaknesses with respect to those areas, selecting appropriate opportunities for change, and establishing priorities and timelines; and (4) identify a few high potential and reasonably priced applications of technology that can be implemented before the plan is completed. I modified step #3 to include "identify the institution's core values and likely future directions."

The first strategy in Penrod's model is to gain legitimacy for the planning process. I began by asking the university's chief academic committee, which is chaired by the provost, to disband both the old Computer Advisory Committee and the Library Committee and then to establish a new committee, the Information Services (IS) Committee, to plan for all information services. The provost let the faculty know that we would not be filling the vacant librarian position until this new committee decided what kind of librarian the institution needed, and that the first task of the committee would be to develop a strategic plan for the library. Since the previous library director had made all hiring decisions unilaterally, this announcement sent a clear message that the library was entering a change mode and was willing to surrender some autonomy in favor of a rocket thrust forward.

The next strategy in the Penrod model is to put together a powerful planning team. Since the Information Services Committee would serve as the planning team, I made sure that the faculty appointed to the committee were held in high respect by the rest of the faculty but also could be counted on to press for change. The Student Government appointed five articulate students who were dissatisfied with library services. Since the library suffered from inadequate electrical service and the plant and property department claimed that this could not be remedied, I asked the director of plant and property to serve on the committee -- and he was overwhelmed. "No faculty group ever asked me to join it before," he said. Thus, the committee consisted of five activist students, five outspoken faculty, the acting library director, the director of plant and property, and me.

It was this committee that was charged with uncovering the institution's implicit core values and likely future directions. In order to do this, the committee members decided that they needed to know:

* the provost's vision of where the school ought to be in five years;

* the number and characteristics of the students now served and those the school expects to be serving five years from now;

* the skills and attitudes the students have when they enter and those the university wants them to have when they leave;

* the school's current and desired competitive edge;

* the academic programs that contribute or should be contributing to that competitive edge.

The committee used three methods to obtain the information it needed to answer these questions. The first was to identify, collect and review relevant published documents. These included: Board minutes, consultant reports, student evaluations, the institutional self-study, the long-range plan, the college catalog, and the viewbook.

The committee also analyzed quantitative data. This information included historical and current enrollment figures, staffing patterns, the standardized test scores of the freshman class, and other data concerning the skills of entering and graduating students. The committee also interviewed academic decision makers. In addition, individual members of the committee held many informal discussions with faculty, especially those who had been here for many years and those in programs that seemed to be flourishing.

The committee eventually decided that most people in the university community believed the following things about the school:

1. The students the university serves are of average academic ability and usually come from homes where the parents have not graduated from college and little scholarly activity takes place.

2. The faculty intends to develop in these students a respect for learning, the ability and the desire to engage in self-directed learning, and the knowledge and skills needed to have successful careers. Opinion is divided as to how successful the school is with respect to these intentions.

3. The most popular programs for full-time students are business, health sciences, and teacher education; these are likely to continue to be the source of most of our full-time students.

4. The university is in poor financial condition and needs about 1000 full-time students in order to be in good financial shape instead of the current level of 700 full-time students. Part-time students generate marginal revenue, but, due to the competition of nearby low-cost state colleges, will never provide significant income to the university. The budget for the coming fiscal year assumed a fifteen percent increase in full-time students, but most people interviewed doubted that the full increase would be achieved.

5. Two of the four graduate programs are not competitive and unlikely to become so. The remaining two programs are currently competitive but changes in the tax laws and increasing competition from low-cost state institutions may decrease their competitiveness.

6. The market in which the university operates is extremely competitive. Even those faculty who believe that the school does achieve its intentions with respect to student outcomes asserted that greater efforts are needed to improve the academic programs and to market these programs successfully.

Once the IS Committee decided upon the six beliefs concerning the core values and the directions the school was likely to take in the future, it began to examine the relevance of the current mission of the library with respect to these values and directions. As part of its evaluation of the mission, it looked at the nature and quality of information services provided by schools that served similar students. And, it analyzed emerging trends in information technology to see which of these trends had the potential of facilitating the educational goals of the institution.

For example, the IS Committee learned about CD-ROM; electronic retrieval of full-text documents; regional and national resource sharing networks; inter-library loans of periodicals done over a telephone line, from PC to PC to student's floppy disk; librarians as teachers; and information management literacy replacing computer literacy as the focus of the 90's. They also learned the true costs of acquiring a book or periodical (the cataloging, shelving, and storage costs as well as the initial costs) which helped them to understand why the emphasis in modern libraries is moving from quality of acquisitions to quality of access.

After examining these exciting possibilities, they had to come back to earth, to the values of the institution and the realities of limited resources. But this process of imagining the possibilities helped the IS planning committee form a vision of the role the library could play in enhancing institutional vitality.

The IS Committee also worked hard to identify the library's strengths and weaknesses. It assessed the political and cultural environments as well as the technical environment in order to determine the strengths and weaknesses. Then, using information about the university's values and likely future directions, the library's strengths and weaknesses, and trends in information management and information literacy, the IS committee set about redefining the mission of the library and creating a vision of what the library could look like in the 21st century. It saw the new mission of the library as having three components:

Technical:	The library provides the university community with timely, convenient, cost-effective access to scholarly information.
Instructional:	The library plays a key role in assisting university students in the development of information competencies.

Physical: The library provides a place conducive to discovery and self-education outside the classroom and laboratory.

The committee's vision of the library in the 21st century was based on the three components of the mission statement. (Special thanks to the MIT libraries for providing the IS Committee with some of the ideas and phraseology that shaped the vision.) This vision is:

The Library as a Place:

In a small liberal arts college, the library serves many functions: social, cultural, and academic. Of special importance to the experience of a liberal arts education is the library as a place: a building housing physical collections that can be accessed easily by the university community.

The university's library in the 21st century will continue to be a place for self-education and discovery; a place whose physical appearance proclaims a reverence for knowledge; and a place that serves as a haven from the pressures of communal living.

The 21st century will see the increasing importance of the library as a place where the university community obtains access to information resources located outside the physical boundaries of the library.

The Librarian as an Information Guide:

By the beginning of the 21st century, the major role of a university librarian will be as an information guide through the increasingly complex maze of information. Through course related and course integrated instruction, librarians will assist in the education of students in the structure of information in their field, in finding cost effective strategies for retrieving that information, and in enhancing their ability to use information in life-long learning.

Librarians will assist faculty and staff in the selection of and access to information services provided by external vendors. These information services often will be supplied directly to the individual's office or home workstation.

The Library as an Organization:

The pace of change in the information world will require flexibility in assigning library staff and services. Skills will be more important than credentials. Staff development will be an essential component of the library budget. Measures of the quality of access to materials will replace the number of volumes in the library as a yardstick for excellence.

At this point in the project, the IS committee had reached a working agreement on a set of beliefs about the university that it believed were core and commonly held by all, or almost all, factions in the university. It had used these core beliefs and its knowledge of trends in information science to redefine the mission of the library and to create a vision of what the library should be like in the 21st century.

Its next step was to define strategic goals in support of the mission and the vision. It is to this set of goals that it would ask the faculty, administration, staff, students, and Board to commit, and it is this set of goals that would drive the objectives and the activities of the library for the next three to five years. These goals are listed below:

* Become an active participant in local, regional, and national information networks.

* Offer a comprehensive instructional program in information management that will assist students in each of the university's majors to become effective and efficient managers of information.

* Develop an organizational structure that will allow the library to quickly and effectively respond to the changing characteristics and information needs of the university community.

* Remodel the library in order to create a flexible, comfortable environment and to facilitate access to a variety of information sources.

* Develop successful proposals to external agencies to fund library projects.

* Develop and manage collections of materials essential to the instructional programs of the university.

The next step was to define the 1-year and 3-year objectives that needed to be accomplished in order for the library to achieve its strategic goals and fulfill its new mission. The IS Committee made sure that each objective was closely tied to the core beliefs about the university and to the library's new mission and strategic goals. For example, one of the 3-year objectives is:

> have in place a comprehensive multi-leveled information management instructional program that will begin with the freshmen seminar and intensify and become major specific as the student moves through the university. The program will include focused library services and instructional materials, as well as formal and informal instruction, and will be designed to assist the student in the development of life-long learning skills and attitudes.

This goal is clearly related to the belief that the school's students are first generation college students who come from homes where scholarly activity is not the norm. It is also related to the faculty's goals to promote life-long learning and to provide students with the knowledge and skills needed for successful careers.

The fourth strategy in Penrod's model involves implementing inexpensive but exciting projects during the plan development phase so that people can see that progress is being made. We decided to install CD-ROM workstations that featured electronic indices of interest to students and faculty in business, health sciences and teacher education. The development office and the colleges of business and health sciences helped to obtain the money for these projects because they had been kept involved throughout the planning process and were excited about the goals. The installation of the first workstation was a minor wonder on the campus. Comments like "I never thought I would see the day" were heard from students and faculty who came to view it.

Evaluation

The strong relationship between the plan's goals and those of the university made the critical difference in winning the support of the faculty, students, administration, and Board. All of the one and three-year objectives were achieved on schedule. While the project was quite successful, it was also traumatic for the library staff. Greater effort should have been made to involve the library staff in the planning process.

Since the IS committee identified six beliefs about the school and used these to guide the development of the strategic plan for information services, it might be interesting to reexamine the six beliefs. A new permanent president has been in office for one year, and he has been attempting to identify a strategic mission for the school. He has travelled throughout the country meeting with alumni groups to get their input and has held many other meetings on campus and in the community. The Task Force that he appointed to consider the strengths and the mission of the school eventually agreed upon most of the same beliefs that the IS committee had uncovered.

The one major difference concerned the programs of competitive advantage. The IS Committee believed that these are teacher education, health sciences, and business. The Task Force agreed that the school has a competitive advantage in its health sciences and business programs, but it is debating whether teacher education may be on the decline and may be too expensive a program to maintain. The Task Force has recommended that the school consider developing a Center for Government Studies to take advantage of the school's location in sight of the state capital and its many warm relationships with the legislature.

The Task Force agreed with the IS Committee that a significant increase in the number of full-time students is necessary in order for the university to achieve financial stability, and it has deemphasized part-time and graduate students. It has stressed that the number of full-time students will increase only if the university focuses on its programs of competitive advantage and improves academic quality - all goals of the strategic plan for information services.

While we will never know what would have happened if the IS Committee had developed an IS plan without determining the core values and likely strategic directions of the university, it seems evident that determining and then using these values and directions as a foundation for the IS strategic plan facilitated its acceptance by the university community and enabled the acquisition of the resources needed to attain the plan's goals.

THE BIOMEDICAL INFORMATION COMMUNICATION CENTER: PLANNING AN INTEGRATED ACADEMIC INFORMATION MANAGEMENT SYSTEM

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Joan S. Ash, M.L.S., M.S., M.B.A.,
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Oregon Health Sciences University
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ABSTRACT

The Biomedical Information Communication Center (BICC) at the Oregon Health Sciences University (OHSU) combines academic computing, the library, biomedical communications, and medical informatics, to serve medical, dental and nursing faculty, students and staff. As a National Library of Medicine Phase III IAIMS (Integrated Academic Information Management System) site, the BICC has conducted needs assessements and planned for an information technology system to provide desktop access for users campus-wide on a variety of platforms. Projects to accomplish this include a campus-wide StarLan network; ORHION, an electronic information service; and a campus-wide database system. Concurrent with this planning is construction of a BICC building, which, when ready next year, will serve as a base for these integrated systems. By equipping health care students and professionals involved in education, research, and patient care with access to information technology, the BICC can achieve its goal of supporting the provision of quality, cost-effective care in Oregon.

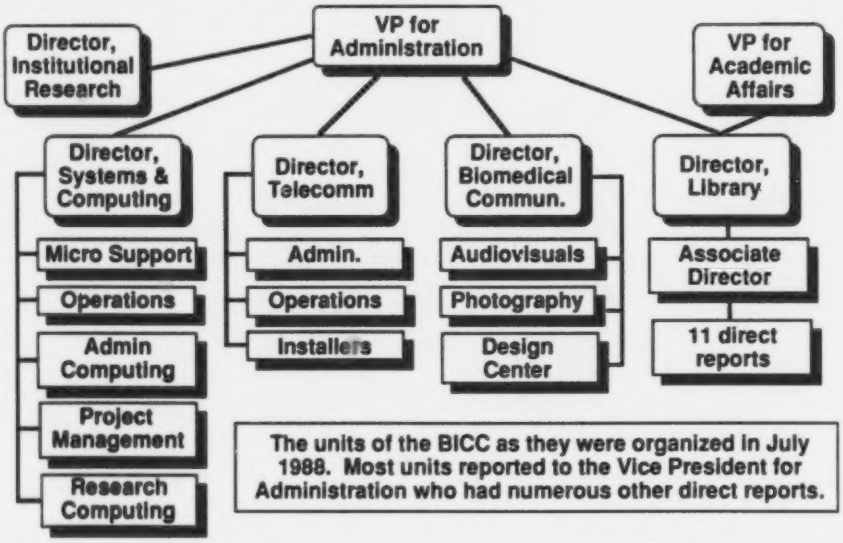
INTRODUCTION

The Biomedical Information Communication Center (BICC) at Oregon Health Sciences University in Portland is the campus-wide organizational entity for information technology. It combines academic and administrative computing, the library system, biomedical communications, telecommunications, and health informatics research and development under one person who serves as the chief information officer for the university.

Oregon Health Sciences University (OHSU) is one of eight schools in the Oregon State System of Higher Education. It combines schools of medicine, nursing, and dentistry with three research institutes, a children's center and two hospitals. While bachelor's degrees are awarded through the School of Nursing and allied health departments, the campus is primarily graduate level.

THE OREGON HEALTH SCIENCES UNIVERSITY. OHSU recently distributed a long range strategic plan, encompassing educational, research, clinical care, outreach and community service goals. [1] The goals reflect OHSU's role as the only graduate health education institution in Oregon, and one of only two in the Pacific Northwest. There are approximately 6,000 physicians and 30,000 other health related professionals in the state. OHSU serves these groups in several ways, including continuing education and information services and as a referral resource for clinicians in the field. Information use on campus is intense because educational, research and clinical care needs are great.

THE BICC. Begun in September, 1989, the BICC is a unique joining of diverse information services which can now be closely coordinated because they are part of the same organization. It is considered one of the three research institutes on campus and is separate from any one of the three schools.


VP for Administration
Director, Institutional Research
VP for Academic Affairs
Director, Systems & Computing
Director, Telecomm
Director, Biomedical Commun.
Director, Library
Micro Support
Operations
Admin Computing
Project Management
Research Computing
Admin.
Operations
Installers
Audiovisuals
Photography
Design Center
Associate Director
11 direct reports

The units of the BICC as they were organized in July 1988. Most units reported to the Vice President for Administration who had numerous other direct reports.

Figure 1.

Prior to the BICC, the different information units on campus reported to different vice presidents and were somewhat isolated (see Figure 1). The library collaborated regularly with Biomedical Communications and also with Systems and Computing while implementing an automated library system, but areas such as Telecommunications were not similarly integrated. Coordination was difficult because of incomplete or inaccurate knowledge of other departments. Computing activities, for example, were fragmented and spread among a systems and computing department, a research computing department, and an instructional media department housed in the library which provided public use microcomputers. Hospital information systems remains part of the hospital and outside the BICC and the physical plant department still does some hardware repairs, but most campus computing is now together under the BICC.

THE BICC AS AN INTEGRATED ACADEMIC INFORMATION MANAGEMENT SYSTEM

In 1982, a landmark publication from the Association of American Medical Colleges (AAMC) documenting a study done for the National Library of Medicine (NLM) had a profound impact on academic health sciences centers across the country. The principal investigator for this study was a health sciences librarian, Nina W. Matheson, M.L.; project directors were John A.D. Cooper, M.D., Ph.D. and Marjorie P. Wilson, M.D., both from the AAMC. Titled Academic Information in the Academic Health Sciences Center: Roles for the Library in Information Management, the paper recommended that 1) integrated information management networks be utilized to draw on academic, operational and clinical information and 2) academic programs be developed to teach faculty, staff and students how to use information technology. [2] The National Library of Medicine acted quickly to provide leadership in creating what it termed Integrated Academic Information Management Systems (IAIMS). To stimulate academic health centers to study the way information should be handled, it offered grants for IAIMS planning. William Stead, M.D., IAIMS director at Duke University, has written, "A strategic planning process provides the opportunity to guide decisions about individual projects so as to bring them together as an applied IAIMS laboratory." [3]

Originally it was thought the institutions that succeeded in receiving grant funds would provide a single model for others. Actually, each campus has developed its own unique IAIMS program. While some focus on the library, with data from elsewhere being merged with bibliographic data, others are more clinically oriented or more inclined towards biomedical research. Nevertheless, IAIMS has been widely hailed as a successful project. The NLM initiative has changed the way work is done at more than just the grant funded institutions. The concept has now spread to such an extent that hospital libraries are being funded by NLM to do similar studies. Grants are awarded for Phase 1 studies, which are planning grants; for Phase 2, model development; and for Phase 3, full implementation. Institutions must reapply for each phase since the grants are extremely competitive.

OHSU is presently one of five institutions in the implementation phase, with somewhat over $5 million to use over a five year period. In addition, Congress has appropriated $14.5 million for a building to house the new BICC. The BICC is unique in that it is the only Phase 3 IAIMS site with this combination of resources and the only one with a statewide outreach mission. Thus, it can build on what others have done to integrate information on their campuses, but will explore new ground in offering these services on a statewide basis.

IAIMS PLANNING AT OHSU

The OHSU campus began its official planning phase for the BICC in 1984 when it was awarded a planning contract by NLM. The president of the university formed two committees to assist in the effort: a National Technical Advisory Committee made up of experts in business, information technology, and informatics, and a Faculty Advisory Committee of campus individuals. After deciding on some initial directions for BICC planning, the committees proliferated under the guidance of a new acting president in 1987 to become 11 different groups totalling nearly 100 people. There was an Interdisciplinary Oversight Committee similar to the National Technical Advisory Committee and a Planning Committee made up of chairs of nine task forces plus the task forces themselves. Each task force generated a report on a specific area of planning (telecommunications, databases, vendor opportunities, etc.) and these were molded into an IAIMS Phase 3 proposal submitted to NLM in 1988 and awarded in June, 1989.

The university now had IAIMS implementation grant funds in one hand and a brand new strategic plan for OHSU in the other. In addition, it had just hired J. Robert Beck, M.D., a medical informatician and clinical pathologist, to head the new BICC. He accepted the dual task of merging the different information services departments into one unit and of launching an aggressive IAIMS effort. In addition, he is leading the planning effort for a new building, to be completed by June, 1991.

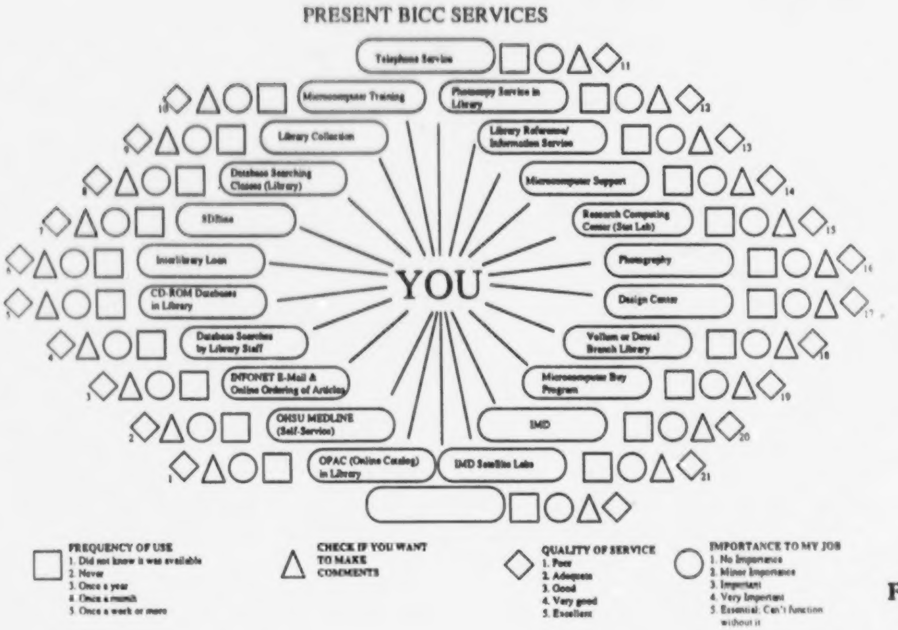

PRESENT BICC SERVICES
YOU
1 OPAC (Online Catalog) in Library
2 OHSU MEDLINE (Self-Service)
3 INFONET E-Mail & Online Ordering of Articles
4 Database Searches by Library Staff
5 CD-ROM Databases in Library
6 Interlibrary Loan
7 BDline
8 Database Searching Classes (Library)
9 Library Collection
10 Microcomputer Training
11 Telephone Service
12 Photocopy Service in Library
13 Library Reference/ Information Service
14 Microcomputer Support
15 Research Computing Center (Stat Lab)
16 Photography
17 Design Center
18 Vollum or Dental Branch Library
19 Microcomputer Buy Program
20 IMD
21 IMD Satellite Labs
FREQUENCY OF USE
1. Did not know it was available
2. Never
3. Once a year
4. Once a month
5. Once a week or more
CHECK IF YOU WANT TO MAKE COMMENTS
QUALITY OF SERVICE
1. Poor
2. Adequate
3. Good
4. Very good
5. Excellent
IMPORTANCE TO MY JOB
1. No Importance
2. Minor Importance
3. Important
4. Very Important
5. Essential; Can't function without it

Figure 2.

NEEDS ASSESSMENTS. Once the BICC director was on board, needs assessments became the first order of business, so that Dr. Beck could become more familiar with the areas under his control and with the desires of the BICC's clientele. In the fall of 1989, three needs assessments were done to gather information from users. The first studied current on-campus users of BICC information services. BICC staff generated a random sample of 100 faculty, residents and students and trained volunteer interviewers. Three graphical survey instruments were developed, based on one used at Dartmouth Medical School, another IAIMS site. The first two survey instruments were designed to help evaluate present BICC services (see Figure 2) and to identify the enhanced services which would be most useful. Services, such as microcomputer training or database searching, were listed and respondents rated items on the list concerning their present quality or future usefulness and desirability. The third instrument included a list and explanation of possible future BICC services and asked for ratings. The interview method was selected so that interviewer and interviewee could continuously interact. Interviewers volunteered from all areas of the BICC; one of the most gratifying aspects of the survey project was the synergy among the surveyors as they were trained.

The on-campus survey revealed that the BICC must improve its present information services. It also indicated the need to offer enhanced services soon and well because expectations are that the advent of the BICC as an organization will have immediate benefit to users. There was a clear cry for more training and support for microcomputer use on campus. With the installation of a campuswide data network in progress, this need has become even greater.

To assess the needs of health professionals throughout the state, the BICC education coordinator conducted four focus groups in smaller Oregon towns during November and December, 1989. The focused group interview technique has been shown to be effective in market research and is another way to assess needs efficiently over a short period of time. The groups discussed what kinds of information they most needed and the technologies they were willing to use to access this information. The BICC differs from other IAIMS sites in that it has a mandate to serve the entire state. Outside of the Willamette Valley, the state is primarily rural, so mechanisms for providing electronic information to these remote areas, so hard to reach physically, are of critical importance to fulfilling the mission. From an organizational point of view, outreach services must be targeted differently from campus services. For example, continuing education via video or computer was high on the list of desired BICC services for these users but not for campus personnel who have it readily available.

Finally, the needs of BICC personnel were assessed via over 100 individual staff interviews to ascertain current job duties, perceived needed changes, special skills, career aspirations, and present and desired roles within the BICC. Interview forms were completed but were seen only by the BICC director and two coordinators to protect confidentiality. An overwhelming conclusion with organizational implications was that staff members were expecting change and most were hoping for new roles. There was great desire for the organizational structure to be clarified soon to reduce uncertainty. There was a certain amount of anxiety expressed as well. Nearly every interviewee desired more education and/or training in technical areas, particularly microcomputers. A large number volunteered to teach courses in their area of expertise in exchange for training from other departments. An immediate response from the BICC was to open all courses offered at that time on microcomputer applications and library training free to any BICC staff member.

REORGANIZATION. After conducting the needs assessments, the reorganization team, which consisted of the coordinator for planning and personnel and the communications coordinator, created a BICC organization model, based on identified goals and the findings of the needs assessments. The reorganization team presented its proposal to the BICC executive committee. This group, made up of the Director, Associate Directors and Administrative Officer, evaluated the proposal and made final changes. The Associate Director of each division in turn presented it to their middle managers and department heads for further refinement. The final draft was then presented to BICC staff in two ways: on a one-to-one basis by immediate supervisors and in an all-staff meeting in January, 1990. On the assumption that radical restructuring brings rapid change, [4] the target date for full implementation was set as July, 1990.

Before the BICC existed, the libraries, telecommunications, and the computing center existed separately and had varied reporting relationships. They comprise the largest BICC departments in terms of dollars and staff. In addition, the BICC was given oversight of Biomedical Communications (audiovisuals, photography, and graphic arts), microcomputer support (public use microcomputer areas, training and microcomputer store), and research computing and biostatistics support.

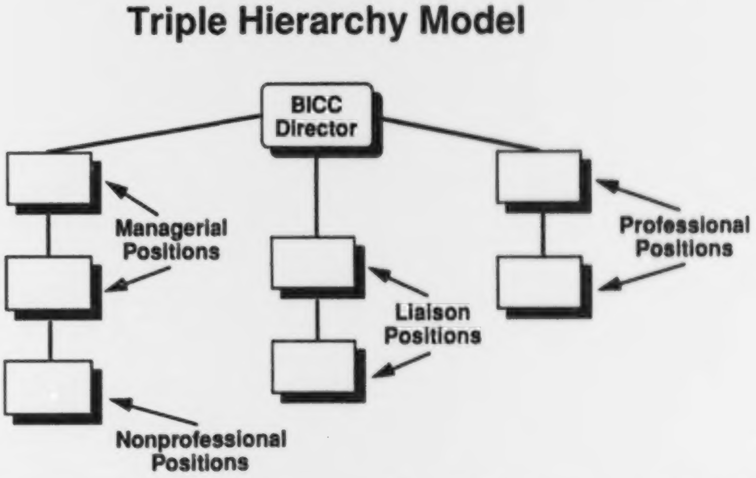
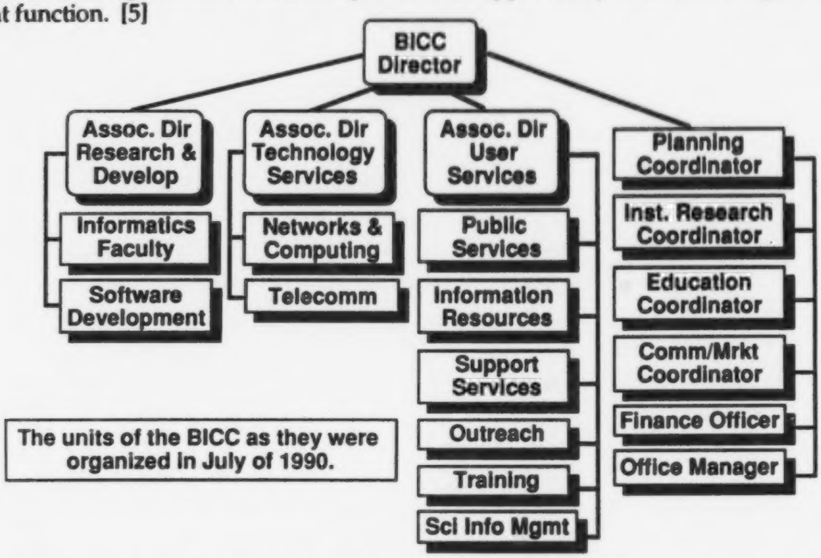


Figure 3.

The new BICC organization is a triple hierarchy (see Figure 3). Where a dual ladder hierarchy allows professional staff to advance in their careers as technical specialists or as managers, the triple hierarchy adds another dimension, the liaison hierarchy. As examples, a UNIX applications specialist is on the technical ladder, the manager of Photography is on the line management ladder, and the Training Coordinator is on the liaison ladder. This type of organization has been implemented with success in high-technology firms. There is a hierarchical organization chart which forms a focus and base for staff who need structure . However, project staff are drawn from all departments in a matrix management sense. There is an expanded central staff of coordinators as well as coordinators within User Services. They handle areas with a high potential for conflict such as the purchase of expensive equipment, the coordination of performance appraisal and rewards systems, budgeting, project management assignments, statewide services, public relations, and training. The intention is that professionals on the staff, whether they be librarians, computer scientists or biomedical photographers, will be given more autonomy and more opportunity to advance regardless of their management function. [5]


BICC Director
Assoc. Dir Research & Develop
Assoc. Dir Technology Services
Assoc. Dir User Services
Planning Coordinator
Informatics Faculty
Networks & Computing
Public Services
Inst. Research Coordinator
Software Development
Telecomm
Information Resources
Education Coordinator
Support Services
Comm/Mrkt Coordinator
Finance Officer
Outreach
Office Manager
Training
Sci Info Mgmt

The units of the BICC as they were organized in July of 1990.

Figure 4.

Under the new organization the BICC is divided into three divisions: User Services, Technology Services and Research & Development (see Figure 4). In addition, there is a central administrative core. User Services has six areas: support services (photography, audiovisuals, the microcomputer store and support), microcomputer training, outreach activities, research computing and biostatistics support, public services, and information resources. The latter two areas correspond to public services and technical services in a traditional library. Public Services includes reference, circulation, interlibrary loan and photocopy services. Information Resources combines cataloging, serials and acquisitions functions. User Services can be considered the expanded library. The Associate Director for User Services functions as university librarian, but he has vastly expanded responsibilities because his division includes microcomputer support, biomedical communications and microcomputer training. The graphic arts department, formerly part of Biomedical Communications, was phased out last year in favor of teaching users to use graphics software themselves or referring them to private artists as a cost saving measure. Middle level managers handle support services, public services and information resources, each of which includes several departments. Other activities, such as outreach services, are managed by "coordinators" who perform liaison activities in staff roles reporting directly to the Associate Director.

Technology Services was divided into two main areas: telecommunications, and networks and computing. At the helm is an Associate Director with a background in the high technology private sector and entrepreneurial enterprise. Whereas this division does not include the variety of departments User Services has, it controls the largest budget and manages most of the project work. The telecommunications area includes the central switchboard and paging system for the university and the installation and maintenance of voice technology. With the installation of a new voice system on campus this year, it has become the university's own phone system. The campus was wired for data communications simultaneously. The two departments have been working side by side to complete the installation and organize related projects. As a result of anticipated growth in the networking arena and to keep end user services together, most training and microcomputer activities have been taken from Networks & Computing and put into User Services. This was not a popular move in the beginning because of some territorial problems, but has now been accepted as a logical result of the reorganization.

Research & Development is currently the smallest unit of the BICC. In addition to the health informatics faculty and their staff, a software development group is housed in this division. It is anticipated that the department will recruit more faculty, will begin a fellowship program, and will be the incubator for new products which can then be implemented by Technology Services and offered to users by User Services. An example is the physician's workstation project where BICC staff are developing a graphical user interface and other software to easily access clinical and bibliographic information from the same platform. Thus the BICC is a concentric organization, with Research and Development at its hub, the service departments in the second layer, the university clients in the penultimate position, and Northwest health professionals the ultimate end users of BICC products and services (see Figure 5).

BICC Concentric Service Model

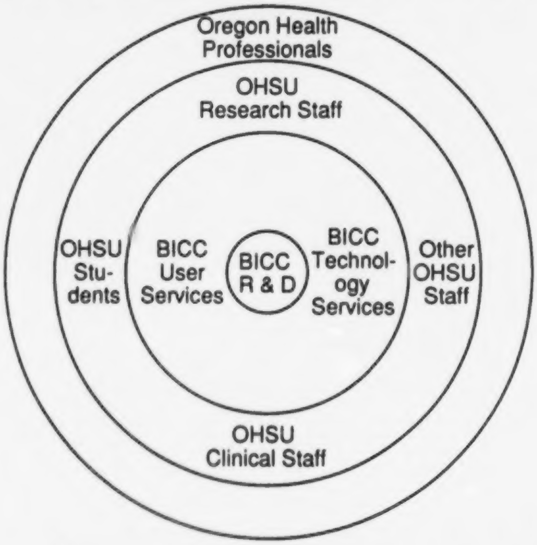


Figure 5.

THE NEW BUILDING. During the initial planning phase for the BICC, the conceptual design for the new building became increasingly clear. It was evident that a large part of the library operation would be housed there, but only the most used items in the collection would be moved in anticipation of full text retrieval becoming available at some point to provide the less used items. It was also clear that considerable space would be allocated to a training and teleconferencing center so that teleconferences could be held with underserved areas outside of Portland. The microcomputers for public use will be located near a microcomputer store and display area with training and support staff readily available. In addition, the health informatics staff and BICC administrative staff will reside on the top floor. This mix of functions mirrors the IAIMS concept. It reflects a true integration of information services. A location for the building was selected in the center of the campus with bridges to both sides of the campus. The location echos the philosophy that information is central to the educational, research, and patient care responsibilities of the university.

Groundbreaking took place in August, 1989. At that time, interior space planning had not begun in earnest because the director was not yet on board. Instead, the shell had been designed and the interior envisioned in a flexible way. Space planning involved virtually all staff once the reorganization was clear. A contract for furniture, signage and miscellanous office equipment will be let by January, 1991. The building will have five levels in addition to a mechanical level for the larger machines. The first level is the training/teleconferencing space. The second level will house a library collection in compact shelving. Library services and current journals will be on level three, the main entry level. The fourth level will have microcomputer services, including the store, training, support and self service equipment. The west wing of floors two, three and four will house BICC staff offices. The BICC administrative and research and development staffs will live on the top floor. The reorganization was done so that functions which directly serve the public could be moved in toto to the new building. This provides "one stop shopping" for information services to any client who walks through the door.

As the BICC prepares to move into its new building, it also is working to link the OHSU campus electronically. A campuswide network is essential to becoming a true IAIMS. The Oregon State System of Higher Education has recently provisioned each of its eight campuses with a new telephone system. OHSU chose to install data as well as voice capabilities at the same time, with a successful move to an AT&T System 85 Voice and Data Switch on April 28, 1990. AT&T premises distribution wiring has been completed, and 30,426 feet of fiber and copper wiring have been installed underground to all campus buildings. Individual buildings continue to be wired, with 120 wiring closets rewired and modified to accept not only telecommunications, but also the BICC and the Hospital Information Systems Division (HISD) networks. While HISD had already installed the Token Ring System in the hospital and clinic areas, the rest of OHSU is using the AT&T StarLan Ethernet 802.3 network, partly a result of AT&T's donation of nearly $1 million in network equipment. Obviously, a link between the two systems is a high priority so that patient data from the hospital can be integrated with other types of data generated by the academic side of campus. This is in progress. With nearly 150 users connected to date, the StarLan network now connects terminals, DOS machines, Macintoshes, Suns, a Sequent, NeXT computers, a Harris, an HP, and AT&T 3b2 computers. The number of NeXT computers on the network will expand because the BICC recently formed a partnership with NeXT Computer, Inc. to use the NeXTstation for development work on the physician's workstation.

The network is assisting with the integration of BICC staff functions in a critical way by promoting communication among geographically separate units. All BICC departments are now connected, although some staff do not have their own computers. Electronic mail has been especially effective in promoting horizontal communication across the organization.

OUTREACH. As a high priority in the OHSU Strategic Plan, outreach efforts by the library over the past ten years have paved the way for an electronic information system, ORHION (Oregon Health Information Online). ORHION provides users with a number of electronic services, including Medline (Medical Literature Online from the National Library of Medicine) searching on a locally tailored subset, automatic requesting of photocopies to be charged to a credit card or OHSU account, the online public access catalog of the library, and a growing list of other services. While an older project, Infonet, funded by the Meyer Memorial Trust, began two years ago to offer many of these online services to campus users, the expanded and renamed ORHION service went statewide in April, 1990. The service, offered free on campus, has been measurably successful, with over 850 users registered. Subscriptions are now available off-campus to hospitals and end users, with the result that there are now 19 paid off-campus subscribers and six trying the system on a trial basis. ORHION implementation has required cooperation and communication between User and Technology Services for the customer and technical aspects of the project. For example, when ORHION services were moved from a PDP-11 to a Sun machine, Networks & Computing did the technical work and User Services helped users learn how to access ORHION from the new machine. Campus users can now access ORHION directly on the StarLan network. As the range of ORHION services broadens to include more databases, decision support data, drug interaction data, educational conferencing, etc., ORHION will form the electronic highway between OHSU and health professionals throughout the state.

Through ORHION and other services the BICC supports the education of OHSU students off campus. Recent funding for the development of Area Health Education Centers in Oregon will allow medical and nursing students to take part of their clinical training in rural areas. The BICC will provide essential electronic contact between the students and the OHSU campus. It is probable that less expensive networking will be available through a state program called Ed-Net, which will connect Oregon's schools, from elementary through graduate, for purposes of data and video transmission. Other users, such as hospitals, will be able to send and receive information as well.

ORACLE AS A DATABASE STANDARD. A recent site license agreement between OHSU and Oracle provides the full suite of Oracle products (excluding the manufacturing and financial applications) to OHSU for the next four years. Oracle was selected because it is compatible with the heterogenous computer environment at OHSU and interfaces with existing applications. The BICC is actively planning for marketing, sales and distribution, installation and conversion, training, support and custom programming. This software can run on all hardware platforms currently on campus. By standardizing on Oracle database software, OHSU will be able to integrate database resources across campus more easily.

THE SYNTHESIS PROJECT. Another project critical to the success of the IAIMS program is called Synthesis. Synthesis will provide a computing environment in which users can seamlessly access the BICC network, capture authorized data from a variety of sources, format the data into information, and deliver the information to the user. The project is well underway with a project team already in place and a timeline clearly delineated. Initially Synthesis will capture data from laboratory tests and patient demographic records. A joint effort of Clinical Pathology, the Hospital Information Systems Division and the BICC, the project will involve a number of computers including an AT&T 3b2/1000, a SUN Sparcstation 1+, Clinical Pathology's Stratus computer, and the University Hospital Amdahl computer. A gateway between the hospital Amdahl computer and the StarLan network has been established as part of this project.

EVALUATION

The IAIMS planning process at OHSU includes both formal and informal mechanisms for evaluation of BICC information services. The help desk for campus computer support and a customer support line for ORHION, both basically phone services, gather input on a continuing basis concerning support functions. Formal evaluations are planned for each individual BICC-wide project as part of the project management scheme. Within the BICC, job satisfaction is measured by an annual interview survey of all staff conducted as a follow-up to the initial personnel survey. On campus, an IAIMS Advisory Committee, with members from the teaching and research faculties of the three schools, University Hospital, and the VA Medical Center, plan evaluative mechanisms for BICC IAIMS services. The BICC hopes to evaluate the impact of IAIMS activities off campus if funding can be provided. A needs assessment proposal outlines two assessments, one next year and one three years later, to compare information management before and after ORHION becomes widely used.

EXPANDING THE BICC'S ROLE AS AN IAIMS

Plans for the future include support of the OHSU Strategic Plan in several ways. First, to assist in reaching the educational goals of the university, the BICC will continue to hold its annual Information Technology for the Health Sciences Conference, which began in 1989, and will also develop continuing education programs in information technology, establish an information based education infrastructure, and develop a program in health informatics. To support the research objectives, the BICC will develop a collaborative center for outcomes research (which tracks patients and their response to medical treatment) and will develop a health informatics research program. In support of clinical care goals, the BICC will continue to provide information electronically both on and off campus. The BICC will play an especially key role in OHSU's reaching its outreach goals by aiding the continuing education programs, the Office of Rural Health and the Area Health Education Centers through the extension of ORHION services to further corners of the state. All of these efforts will be enhanced by development of a suitable workstation which will provide "one stop shopping" for information.

CONCLUSION

Oregon Health Sciences University has spent much of the last decade planning for an Integrated Academic Information Management System which can best meet the needs of its geographically diverse clientele long term. Done within the framework of the OHSU Strategic Plan, BICC planning has been accomplished with National Library of Medicine funds. By equipping health care students and professionals involved in education, research and patient care with access to information technology, the BICC can achieve its goal of supporting the provision of quality, cost-effective health care in Oregon.

ENDNOTES

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Reengineering: A Concept for Higher Education?

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ABSTRACT

The introduction of new technologies have throughout history followed a three-stage path before revolutionary changes have been evidenced. First, the new technology does what the technology it has replaced does but faster (transition). Second, the new technology begins to initiate modifications to old processes, resulting in greater efficiencies and enhanced effectiveness (innovation). Finally, new ideas and concepts which were previously impossible have been made possible by new technology resulting in major breakthroughs and significantly increased effectiveness and productivity (transformation or reengineering). To date the majority of changes brought about by computing and communication have resulted from phases one and two of this paradigm. We are just beginning phase three.

Reengineering is the process or reexamining all of our basic assumptions about the way we do things and rejecting those that do not fit the technological capabilities of today; redesigning work processes based upon new assumptions; and "thinking out of the box," that is, refusing to be limited by traditions of the past.

This paper examines the concept of reengineering as it might apply to a college or university campus with particular emphasis upon information management units.

> *Technological change defines the horizon of our material world as it shapes the limiting conditions of what is possible and what is barely imaginable. It erodes taken-for-granted assumptions about the nature of our reality, the "pattern" in which we dwell, and lays open new choices.*[1]
>
> Shoshana Zuboff

INTRODUCTION

The evolution of information technology as presented in Nolan's Stages Theory is broken into three eras. The data processing (DP) era (from 1960 to 1980) was the gestation period for computer technology. During this era, new technology was used to make existing organization structures more efficient. The mainframe was king, centralization predominant, and systems were "provided for" end users. The next stage, the information technology (IT) era (from 1980 to 1995), was founded upon three fundamental infrastructures: (1) IT departments, (2) college and university computer science programs, and (3) a diversified computer service industry. This era has enabled the computer to be brought out of the basement, to empower end users and make it possible to change the way work is performed. The network era is the third stage (from 1995 to beyond 2010). It will serve an information/service economy where knowledge workers are predominant, organizational structures are networked, planning is visionary, intangible values are considered, the competition is global, and information technology is seen as an enabling force. It will be the period of the transformed or reengineered enterprise.[2]

> *For this is the dawn of the Powershift Era. We live at a moment when the entire structure of power that held the world together is now disintegrating. A radically different structure of power is taking form. And this is happening at every level of human society.*[3]
>
> Alvin Toffler

WHY REENGINEER?

In the world in which we now live, capital and/or human resources no longer guarantee success. Service, quality, speed of response and innovation are now the determinants of success. The rapid changes, with which we all must deal, mean that actions based primarily upon past experiences are no longer valid. We have entered a time where applying new knowledge first is key. It is analogous to a "permanent white water" river rafting journey.[4]

Over the past several years, we have invested heavily in information technology. Much of that investment has focused on automation, using technology to mechanize "the business." This has left existing processes relatively intact and simply used computers to speed the time for completion. Unfortunately, many job designs, work flows, control mechanisms, and organizational structures came of age in a very different competitive environment well before the advent of computing and digital communications. The processes were geared to support a bureaucracy and to provide efficiency and control. For the most part, work has been organized as a sequence of separate tasks, and complex algorithms are used to track progress, discover mistakes, and subsequently correct errors. Such processes have not kept pace with the changes in technology, demographics, or business objectives. It is, therefore, necessary to reexamine outdated processes, and in many cases, do away with them altogether and start over.[5]

> *. . . an informating strategy suggests the need for a more wholistic reconceptualization of the skills, roles, and structures that define the total organization. Partial change efforts . . . are unlikely to result in the kind of learning environment necessary for an ongoing and robust approach to the informating process. . . .managing in an informated environment is a delicate human process. The ability to use information for real business benefit is as much a function of the quality of commitment and relationships as it is a function of the quality of intellective skills.*[6]
>
> Shoshana Zuboff

WHAT IS REENGINEERING?

The concept of reengineering or transformation and other closely related ideas such as restructuring, process design concept (PDC), work or business process redesign, high productivity program (HPP), managing office productivity (MOP) and organizational redesign are relatively new, emerging only in the late 1980s.[7,8,9]

Reengineering can be defined as using the power of modern information technology to radically redesign business processes in order to achieve dramatic improvements in their performance.[10] It requires a new information technology strategy and a radical behavior change throughout the enterprise, not just in information resources units.

The business strategy must focus upon a market driven quality (MDQ) orientation. This involves: (1) meeting customer desires, (2) aggressively moving to practically eliminate defects or errors, (3) significantly reducing cycle or response time, (4) dramatically increasing employee authority, responsibility, and participation in decision-making, and (5) creating new standards of measurement for evaluation.[11] Fulfilling the business strategy requires that there be a linkage between building quality into programs and the IT strategy for the enterprise. This means that information systems can no longer be seen as a business function, rather that the focus must be upon the information that is needed to run the business. It involves a change from managing information systems (IS) as a utility, to managing IS as an agent of change.[12]

The principles of reengineering must be applied to the entire enterprise and some will emerge from the type of learning environment described by Zuboff. A few principles such as the following are already becoming evident.

Organize around outcomes, not tasks. This is a purposeful movement away from the centuries old notion of specialized labor and from the limitations inherent in paper filing systems. It often results in compressed responsibility for a sequence of steps and the assignment of the total function along with appropriate authority to a single person or unit.

Have those who use the output of the process perform the process. This is another example of moving away from specialized labor. Many opportunities exist to change procedures so that individuals who need the result of a process do it themselves. When people closest to a process perform it, the overhead of managing it is substantially reduced. Additionally, coordination, liaison, and interfaces between those who perform the process and those who use it can be eliminated.

Subsume information processing work into the real work that produces the information. This disputes the old rule about specialized labor and the assertion that people at lower organizational levels are incapable of acting on information they generate. It will usually require moving work from one person or department to another person or department.

Treat geographically dispersed resources as though they were centralized. The arguments regarding the benefit and tradeoffs of centralization versus decentralization are long standing in almost all organizations. Now databases, networks, and standardized systems allow for benefits of scale and coordination while maintaining the benefits of flexibility and service.

Link parallel activities rather than integrating their results. One kind of parallel processing is where separate units perform the same function. Another is where separate units perform different activities that must eventually come together. This principle suggests forging links and coordinating between parallel functions while in process rather than at completion.

Put the decision point where the work is performed and build control into the process. This contradicts a basic assumption of bureaucracy that people actually doing the work do not have the time nor inclination to monitor and control it and that they lack the ability to make decisions about it. If the doers become self-controlling and self-managing, hierarchy and the slowness and inflexibility associated with it begin to disappear.

Capture information once and at the source. Relational databases and networks make it relatively easy to collect, store, and transmit information today. This eliminates any need to live with delays, entry errors, and overhead associated with different individuals, departments or units repeatedly collecting the same information.[13]

> *Universities have stressed the training of critical intellect; they have neglected the training of imaginative intellect. In addition, universities in particular are said to be "loosely coupled" organizations. So the picture is one of confused, multiple-motivated people trying to advance loosely coupled institutions with bounded rationality while hoping to find ways to express themselves without sustaining any losses.*[14]
>
> George Keller and Ann McCreery

SOME IDEAS ABOUT REENGINEERING A CAMPUS

As the 21st Century approaches, more and more is being written about the need for colleges and universities to develop a new paradigm to enable them to meet the challenges of our rapidly changing world. There are corresponding writings which make the point that productivity or "bottom line" in higher education is almost impossible to define, quantify or measure and that academic culture makes it exceedingly difficult to engage in enlightened management.[15,16,17]

Without describing the details of such discussions, it is the perspective of this paper that there are compelling factors that must be addressed by higher education. These include needs such as: (1) containing the growth of total expenditures and reducing certain costs, (2) further development of core competence throughout the whole organization, (3) an increase in the quality of instruction, research, and service provided, (4) a reduction in processing or response time of service functions to students, faculty, staff, alumni, or external groups, (5) an enhancement of the quality of worklife in the institution, and (6) the development of an organization that can learn from its own experiences and continually improve itself.[18]

Reengineering a complex organization such as a college or university is a major and serious undertaking. It requires tremendous effort that mandates change in many areas of the institution (an environment that likes neither mandates nor change!). Position descriptions, organizational structure, information systems, policy and procedure -- anything associated with the process of work -- must be examined and perhaps redesigned in an integrated way.[19]

The transformation of an institution will probably begin with a redefinition of prevailing organizational culture. Schein defines organizational culture as "the pattern of basic assumptions which a given group has invented, discovered, or developed in learning to cope with its problems of external adaptation and internal integration, which have worked well enough to be considered valid and, therefore, to be taught to new members as the correct way to perceive, think, and feel in relation to those problems."[20]

The predicted change is from a culture of professional management to one of entrepreneurialism. Comparison invites a long list of contrasts where movement from one culture to the other will include: external controls to internal controls; conformity to rules to creativity within bounds; central control to individual autonomy; rational/logical decision-making to intuitive decision-making; centralized systems to distributed networks; vertical hierarchies to horizontal networks; adult-child to adult-adult professional relationships; and organization centered to person centered focus.[21]

The organizational structure will also change. It will have fewer levels of management and fewer staff functions. The performance of work will revolve around small teams where the membership changes depending upon the project. The entire organization will become much more "customer centered." Information technology will be a facilitating and enabling force in the emergence of these new organizational forms.[22]

In many ways, colleges and universities may well have significant advantages over business and industry in reengineering. Elements of an entrepreneurial organizational culture are already in place in many institutions, particularly regarding academic personnel. The organizational structure, especially in large and/or research universities, may resemble the new order much more so than correspondingly complex business enterprises. Certainly the idea of creating a learning organization should not require a "hard sell" in a college or university. It is, however, important to reemphasize that despite advantages higher education might have, truly transforming a college or university will require significant commitment, consistency of action, and completely dedicated executive leadership with real vision.

Leadership is a key issue in reengineering. The traditional view of leaders is one of stereotyped *heroes*, special people who set the direction, make the key decisions, and energize the troops. They are great men and (occasionally) women who rise to the fore in times of crisis. Most may well agree that this perspective is a myth, but as long as such myths prevail, they reinforce a focus on short-term events and charismatic personalities rather than on systemic forces and collective learning.[23]

Leaders in a reengineering environment are responsible for building organizations where people are continually expanding their capabilities to shape their future. Such leaders are responsible for learning and must be designers, teachers, and stewards. These roles require different skills than are possessed by most charismatic heroes. The ability to build shared vision, to bring to the surface and challenge prevailing mental models, and to foster more systemic patterns of thinking is needed.[24]

Strong leadership is essential in transforming organizational culture. In a decentralized, structured organization (such as a university), standard operating procedures determine the allocation of attention of organizational participants unless the leader intervenes. Thus, one element of leadership is the effort to capture the attention focus of organizational members. Three mechanisms to help perform this function are: communication between leader and participants, role modeling, and reward systems. Belief in mission and an honest dedication to the people who must carry it out are crucial to good communication. Role modeling is another form of communication. Behavior exerts leadership whether the leader intends it or not. Rewards can be effectively used to reinforce the priority system for attention allocation.[25]

Measurement of what we do and periodic evaluation of goals and objectives are important now (although neglected) and will be even more so in a reengineered organization. Much current measurement reflects the form of existing position descriptions and the attitude of too many toward work, i.e., we measure whether or not, or how well we complete tasks. In the future, we must focus upon measuring desired outcomes--not tasks--and set up work expectations in the same way. Many colleges and universities do a good job in setting and evaluating goals and objectives. They are, however, almost always organization centered. Reengineered organizations will need to augment management by objectives with management by subjectives.

Management by subjectives (MBS) focuses upon optimizing human performance and requires managers to recognize, understand, and balance formal (organizational), informal (group), and personal (individual) processes. To be successful managers, will need to pay more attention to individual uniqueness, communicate well, and develop personal relationships based upon trust. Facilitating processes, both in small groups and with individuals, will be increasingly important. MBS suggests that: (1) the best way to "get to" someone is to create an environment where people, through communication, make themselves available to change; (2) the essence of communication is not clarity but trust; and (3) communicating well is when people like themselves in your presence.[26]

In a reengineered institution, information technology units will need to make the same kinds of shifts as outlined above but be one of the first units in the organization to do so.

Information technology leaders or chief information officers (CIOs) will need to exhibit leadership characteristics as described. Additionally, a significantly greater proportion of information technology managers will need to provide leadership both within the information technology unit and across the campus for transformation to be successful. As managers in all units assume greater information management responsibilities, information technology managers will more and more find themselves fulfilling roles of designers, teachers, and stewards and facilitating or coordinating across the campus and between units.

One of the basic assumptions underlying reengineering is that information technology planning will become an integral part of institutional strategic planning. CIOs will continue to coordinate campuswide information technology planning and have primary responsibility for information technology tactical and operational plans but the most senior institutional executives must move from being spectators to full participants in strategic information technology planning. They must engage in the process of creating opportunities to strategically apply information technology.[27]

Finally, information technology systems design must reflect the reengineered environment. This will occur in many ways and the following examples are illustrative rather than exhaustive. An open systems model is important as is widely communicated and agreed upon standards. The design must support broadbased access to all organizational levels and varied constituencies with either the need or the right to know. Integrated relational database management systems (that are truly distributed when possible) coupled with state-of-the-art development and inquiry tools will be a necessity. The fundamental design criteria must change from a basic focus on functionality for the primary user to recognize that the system must support the corporate executive user, the primary user, and the ultimate end user. This has ramifications for all levels of software, hardware, and networks.

> *Winston Churchill once said that "empires of the future are empires of the mind." Today that observation has come true. What has not yet been appreciated is the degree to which raw, elemental power—at the level of private life as well as at the level of empire—will be transformed in the decades ahead as a result of the new role of "mind."*[28]
>
> Alvin Toffler

CRITICAL SUCCESS FACTORS FOR REENGINEERING IN HIGHER EDUCATION

Colleges and universities are institutions of learning, and those in the United States are generally regarded as the best in the world.[29] However, the time has come when the question must be asked, are U.S. colleges and universities learning institutions? The transformed, reengineered or informated organization of the 21st Century will be a learning institution. One of the principal purposes of such organizations will be the expansion of knowledge. This will not be knowledge for its own sake, as in academic pursuit, rather knowledge that resides at the core of what it means to be productive in a global economy and world society. Learning can no longer be a separate activity that occurs before one enters the work place or later in classroom settings. It cannot be an activity preserved for managerial or elite technical groups. The behaviors that define learning and those that define being productive have come to be one and the same. Learning does not require time out from productive activity, learning is the heart of productive activity. It is the new form of labor that is now building the "empires of the mind."[30]

How do colleges and universities become learning organizations? The following ideas are offered as further points of discussion regarding what it will take for campuses to be reengineered.

Have a recognition of the need for broadbased, institution wide change to achieve new levels of strategy, commitment, and service. It is believed that this is not a generally held perspective and that even where it is some "initiating spark" will probably be needed to overcome organizational entropy for any serious consideration to be given to reengineering. That spark might come from a crises, a new leader, or an external person or event.

Set forth a well articulated information strategy that is synergistic with institutional decision-making. This is not a glorified information systems plan! It is a strategic direction set forth by executive leadership that recognizes information as a critical resource. It requires access by all levels of the organization and the ability to use information immediately in decision-making as significant elements of providing acceptable service to constituents. Such a strategy would require the information technology plan to be integral to the institutional strategic plan.

Acquire a preexisting critical mass of innovative people and information technology. Rapid, major change with comfortable elements of the work environment is not easy for anyone yet reengineering requires exactly that. Thus innovative individuals capable of handling the change and helping others to do so must be in place during the transformation. An existing information technology infrastructure capable of supporting and sustaining the transformation is also necessary.

Have an information technology staff who see the vision and know that they must plow new ground. It is all too possible to have an IT infrastructure capable of supporting reengineering but not have IT leaders, managers, and technicians who can do so. "Pride of ownership," "This way has always worked," or "If it ain't broke don't fix it," attitudes simply will not mix with a transformation orientation. Information systems people must be in the forefront of any reengineering endeavor, and they must begin within their own unit.

Make a commitment to examine, reorient, and redesign -- without prejudice -- all policies, procedures, and position descriptions to emphasize outcomes. The magnitude of change discussed in the literature points to a complete overhaul of standard operating processes and allocation of attention by organization members to different things. Leadership intervention may cause a change of focus for a while, but permanent change to embrace the principles of a learning institution requires very different standard operating procedures.

Gain acceptance of a wholistic approach to resource allocation. The primary reason to engage in reengineering is to achieve productivity breakthroughs. Positioning an organization to enable transformation, however, will involve considerable time, energy, education, and expense. By and large, the expenditures will have to come from existing resources which means elimination of that which is unnecessary. The institutional focus must be upon mission and the long term good of the organization versus nonaligned unit goals and short term perspectives.

Create an organizational structure that accommodates a learning institution. Metaphors such as a symphony, an adhocracy, a permeable membrane, a collapsed pyramid, and a spider's web have been used to describe structures that will replace bureaucracies.[31,32] Whatever descriptor prevails, the networked organization will have fewer levels, better communication channels, quicker decision-making mechanisms, an outcome orientation, and more flexibility. It will combine the benefits of both centralization and decentralization.

Design an entrepreneurial organizational culture. Basically this is a recognition that institutions of the future will produce, learn, communicate, innovate, and behave only as well as the sum of the organizational participants. An orientation on values and a focus on the importance of the person must be evident. Objectives of the organization, the group, and the individual must be better aligned and coordinated.

Emphasize different leadership characteristics. Vividly articulating a shared vision is crucial to reengineering. It is an ongoing process that requires leaders to continually share their own vision and ask, "Is it worthy of your commitment?" Although fear is a powerful short term motivator, aspiration must endure as the continuing source of learning and growth. The shared vision, therefore, needs to be powerfully positive. Balancing inquiry and advocacy are important skills for leaders of learning organizations; they need to do both well. Transformation leaders must be able to discern between espoused theory and the theory that individuals really put into practice, and they must be able to diffuse defensive routines. Leaders of the future must be able to see interrelationships and not focus on detail complexity. They must avoid symptomatic solutions and be able to move beyond blame. Finally, such skills must go beyond a few individuals at the top of the organization. They need to be distributed throughout.[33]

Reengineering requires "thinking big," extraordinary commitment, and absolute dedication to the accomplishment of organizational mission. It is not a consideration for the timid, but it may well be the path for maintaining the most successful system of higher education in the world.

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TRANSITION YEARS

FOR INFORMATION TECHNOLOGY---

PLANNING IN THE STRATEGIC DECADE

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This paper discusses the ways in which the 1990's represent a transition period for the role of information technology at institutions everywhere. Planning for the evolution and targeted applications of information technology that is truly strategic in scope is essential to success in the decade that bridges two centuries.

Specific points focus on the role of strategic planning in the 90's, the kind of planning required and why it is important. In addition, a discussion of who should be doing the planning and a suggested structure for the process will be highlighted.

Finally, a set of issues to be resolved, checkpoints to pass, and guiding strategic principles will be offered in a "where do we go from here" discussion.

I believe that the role of Information Technology Strategic Planning is to help both the Information Technology Organization and the institution through these transition years. The transition that I believe we are involved in right now is the transition from our DP or "data processing" past to our personal productivity oriented future.

I read an article last week in the HARVARD BUSINESS REVIEW entitled "Crafting Strategy". It was written by Henry Minsberg who is a professor of management at McGill University , and I recommend it to you highly. One of the quotes from Minsberg in the article is that "strategy is both plans for the future and patterns from the past". I would like you to keep that in mind as we talk about strategic planning today because I think a lot of people have the idea that if you are doing strategic planning, it's totally future oriented - - it is all about the future. In fact, I believe it is as much about the past as is it about the future and we cannot forget some of the things we have learned over the last 20 or so years of information technology development.

I'll talk a bit about the role of strategic planning in the 90's, at least as I see it. I think first we have to understand how information technology planning has evolved over the past couple of decades. I think most of us have been involved in project planning and in some of the early days of BSP and the like. Today, when some people talk about strategic plans, unfortunately, they refer to no more than a collection of project plans laid out on an annual year-to-year basis. That is not the kind of planning that I want to talk about today, although that kind of practical, project planning is very important. I believe that it must come after the strategic part of your planning process. It is clear that strategic planning in the 90's has to be linked very tightly to the mission and purpose of the institution. Now for those institutions that already have a mission or purpose statement, that linkage may be easier. There are lots of institutions, however, who have no such statement, and in fact need one in order to be able to move ahead in the planning process. Part of the role in information technology is to help the institution with its own mission or purpose statement.

One of the things that I think are extremely important in the 90's, and we are building into our efforts at UC San Francisco, is the integration of our information technology planning with our long-range development planning. This signals to me a very strong commitment to the fact that there should be one long-range development plan for the campus which includes the plan for information technology support. In fact what we intend to do is to have our information technology strategic plan be a chapter in our long-range development plan for the campus. I recommend this approach for those of you who may be getting ready to do a strategic plan.

One analogy that helps me understand the role of strategic planning is to think of information technology as a lever - a very, very effective lever. The strategic planning provides the necessary fulcrum to achieve the leverage that we can provide to our institutions when the two work together.

I'll talk a bit about planning attributes. Some of these you have probably heard before. One that I feel very strongly about is that strategic planning is, in fact, a process. It is not an event. It is not something that ends up with a document and then you are done. It is something that goes on and on. Therefore, the planning document - your strategic plan - is a byproduct but it is not the product. The process is the product of strategic planning. One key attribute of strategic planning is that it does involve both top management and grass roots levels, if you will: folks out there in the schools and departments that are doing the real work. It needs to be guided from the top in that the executives on your campus need to "buy into" the vision that you establish for the future and make it their own, but you have to provide for local implementation because the real planning implementation work is going to be done at the school and department levels. The two of those together make for a successful strategic plan and planning process. Finally, it is very important that your planning process and your plan drive the budget process. There have been a lot of good plans developed in the past that came out after all the dollars had been allocated. It is important to complete the planning cycle as your budget cycle gets started so that you've got all your ducks lined up. It won't guarantee you will get all the dollars you want, but you will be in the best position to track those dollars early in the budget process.

There are some reasons, at least in my mind, why strategic planning is essential in this decade. One is that it does provide some common direction that allows for local initiative. I think the days of central planning all coming from the top are gone, and we have to provide for lots of local initiative, because that is where most of the good ideas are. Strategic planning does allow for large complex organizations to be able to move forward against some general goals and a vision of the future through local initiative. And finally, given the constrained resources that we have in our institutions the one thing that will get us through this next decade is information technology; but that alone without a strategic plan is going to be useless. So, I think that planning optimizes our ability to use the constrained resources that we have.

Who are the experts? Fundamentally, the planning process experts are those who are at the working level in central administration, in the schools, and in departments. The experts are not consultants whom you go out and hire, although you may need to do that. The experts are not the people who are sitting in the information technology organization nor are they the vice-chancellors or vice-presidents. The people who need to be engaged in the planning process - who I believe have the answers to where the institution needs to be headed - are the folks at the working level. The key in any planning process and in particular with strategic planning is the maximum involvement of staff, those staff who have a stake in the results. If you buy into the fact that the experts are all around us, you really do need a process and a structure to be able to hold concepts together and to keep everybody on the same page.

So I would like to move now into a very cursory overview of a kind of generic planning process. It is one that in fact we are using at UC San Francisco. It is working fine for us but it does not necessarily mean that it is the lock-step planning process that you need to adopt for your campus. Basically, there are several stages, the first involving development of a mission; a vision of where you see information technology and its role in your campus in the future; taking a look at some critical environmental factors that are going to impact the planning process; identifying a handful of strategic principles that can be helpful in choosing among competing priorities; developing your tactical alternatives and plans; and finally a monitoring and recycling process for the plan.

In the mission and vision phase, we look for a linkage to whatever is the mission of your institution. Then we determine what ought to be the mission of your information technology organization, and how that fits the mission of your institution. I will give you a sample of a mission statement which will illustrate that point. In the first phase you are really talking about getting organized; setting up a way in which you can explain the process to the folks who are both going to evaluate its success and who are going to participate in it. There was a large amount of time that we spent this past year just explaining what strategic planning was, how it was going to work, and people's role in that process. That is something that you are going to have to do yourself, because it has to be tied to your own institutional culture. The vision stage is projecting, what are the things that we want our institution to stand for in three to five years? What are to be the attributes of life at the university in that future time? A helpful way of doing that is to take a look at what are some of the attributes of your life today. When I say "your life" I mean, what are the typical things that either facilitate or get in the way of faculty members being able to do their research or faculty members being able to provide a good teaching environment, of students being able to have a good learning environment, of administrators being able to be effective in what they do. Then, project out five years to see if these are some things that, if they existed, are worth shooting for today. I will have some examples of that as well. The principal purpose of the mission and vision establishment phase is to establish a common set of information technology goals against which to measure progress.

I took my staff on a two-day retreat where we ran through a whole strategic planning process as a dry-run for the campus so we would have an opportunity to see how it worked. The mission statement that we came up with for our organization was: "To provide leadership in the use of information technology for the enhancement of personal effectiveness and the promotion of university excellence." You notice you do not find the word "computing" in there. Mission statements by themselves are not going to inspire anyone. They have to be linked to a vision and some strategic principles and the rest but are the place from which to begin the planning process.

When you get into the process of developing a vision of where you want to be three to five years out, you usually develop a list - a fairly long list - of attributes of the future. These are just some examples of some that we came up with:

1. Desktop work stations will cost less than $1,000.
2. There will be a common graphical user interface to all applications.
3. At least 50% of paper forms will be on-line.
4. Information technology will be less visible.

The important thing is that these are statements which are understood both inside and outside the information technology department.

Strategic principles come in several different forms. Some of you may be familiar with the concept of strategic frameworks. The issue is to translate this vision of the future into some hard-nose project plans. Strategic principles are key to this translation process, and I have some examples. Essentially, the principles provide a set of guidelines which can shape the action plans and link them back to the mission and vision. One test of a strategic principle is whether it can be useful at the departmental level in making local decisions that mesh with the overall campus direction. It provides a common point of departure for local planning. Finally, strategic principles establish a set of standards against which to evaluate your information technology investments or projects.

One example is a principle we talked about at Stanford eight or nine years ago. It is one that makes a lot of sense and I think is aspired to by many institutions: "All data should be collected once electronically as near as possible to its point of origin." If this principle is adopted from the top of the organization down, it has a very, very dramatic impact, for instance, on the kinds of administrative applications that you develop or purchase. As simple as it seems, it is a very powerful concept. Another is one that is particularly useful to us at UC San Francisco: "A uniform level of access to electronic data in quality and quantity will be available at all campus locations". Our institution is located everywhere. We have 110 different addresses in the city of San Francisco. We have people scattered all over the place and one of our biggest challenges (and this gets back to information technology being a part of your long-range development plans for the campus) over the next ten years is how do we provide a more or less equal working situation for all of our staff scattered all over the city. One way we can begin to do that is by establishing this principle in terms of electronic access. Obviously this has a lot to say about the kinds of networking strategy we have and our network topology and the like.

Another strategic principle example is "Information technology products should be measured by their benefits not their technical sophistication". At our institution, we do not have computer science department. We essentially have to borrow from things that are at the cutting edge or developed elsewhere. So one of the messages that I am trying to send my staff is "yes, of course, you are going to be evaluated on technical quality, but ultimately we are all going to be evaluated in the benefits that we provide through these applications not by the technical sophistication".

Just prior to moving to the tactical phase of your strategic planning process, it is wise to take a look at critical or environmental factors. This is the time in the process when you identify those things that might affect plan development and implementation. These things can be organizational, they can be political, they can relate to user mix, they can relate to resources. At our particular campus, an organizational one, and partly a political one, we have listed as a critical factor is that the top administrator on the campus, the chancellor, will be gone within two years. He is going to retire. We cannot control the outcome of that, but we should be aware of it. We should not tie our plan to our chancellor personally, because he is going to be out of the picture. So we need to be aware of a planning process that takes these kinds of factors into account.

The next phase is the phase where we used to start planning, ten years ago. We started saying "Okay, we have got so much money" or "We don't know how much money we have got". "We have got these projects out there, I guess we had better line them up and develop project plans for them". The difference between that kind of planning and what I am talking about is the action planning being preceded by the development of a strategic context in which action planning can be placed making it easier to chose among competing alternatives. At my institution (and I am sure we are not unique), up until recently winners among competing alternatives were chosen based on who screamed the loudest, or what school a particular person represented. If you were from School A, you got what you wanted. If you were from School B, you did not get anything. A public strategic planning process like the one I am trying to describe here, allows for the projects to be selected in an environment that is much more open and much more has everyone on the same page. In the tactical alternative stage, we are identifying alternatives to achieving the vision, using the strategic principles as a backdrop or a set of standards against which to measure some of those alternatives.

Once again I will make the point about tactical plans needing to coincide with the regular campus budget process. One of the things that we are working on now is the completion of our first year strategic and tactical plan in time for our budget process which starts in late January. I wish we had more time to do this but since it is a process and not an event, I know that we will fix some things next year when we go through our second iteration.

The last point, is to build in "public" PERT charts. What I mean by this is a charted set of internal technical deliverables expressed externally in terms of the campus' strategic plans - a set of milestones and deliverables that make sense at the departmental level, in the chancellor's office, and in the accounting office. Thus, everyone becomes a part of and can understand and measure our progress. That puts more "heat" on us in some ways but in the long run everybody is at least there with you for the successes and better understands the failures.

I think we have all begun to see that the applications that we either build or buy or the projects that we are involved in, in the 90's are not going to have a single client and many times are going to have the whole campus as a client. So, it is important that your regular progress report go to all of those who have a stake in the outcome.

On the plane on the way out I had the occasion to look at an excellent article by the CIO for Levy Strauss. His name is Bill Eaton and he talks about four challenges the CIO needs to focus on and work with others to achieve over the next several years. This applies not only to CIO's, but to all of us who are professionals in the field. His challenges are ones you might expect. His first one is getting the information technology platform ready for the future. This includes systems architecture - - traditional CIO material. The second is getting business processes ready to take advantage of the information technology platform (getting back to fulcrum and lever analogy). Thirdly, he says getting the organizational structure ready for changes in the way people work. Finally, there's getting people ready for the future, not just information technology people, but all the people; not just technically ready, but physically, ethically, and emotionally ready. I think some of us would say that is a fairly broad charter for the information technology organization but I think there is a lot of truth in what he says in terms of much of what we do in which we will take a proactive role. Strategic planning is going to relate to things far beyond the technology itself. It will determine what role do we play in the way people organize and do their work.

Where do we go from here? I think part of it is that we need to establish partnerships and I don't mean "making friends" with the users. I am talking about establishing strategic partnerships all around the institution and strategic partnerships outside the institutions with vendors and with other institutions. On our own campus, I think that the strategic planning process we have started has identified a whole set of new partners that we in the IT organization would never have thought of linking up with before.

I think the planning process that I have laid out here builds the kind of framework that we are going to need to get through this transition decade. Identify local models that are working and adopt them. There are a whole lot of good things going on right under our noses. I know that almost every week I find two or three things that are happening on my campus that I did not know about before that relate to things my organization should be doing. So one of the things that we have done in our strategic planning process is to solicit from folks on the campus the good ideas that are already out there.

Another quote from Minsberg is that "strategies need not be deliberate, they can also emerge". We don't have to think that we are guiding this fine-tuned machine and we cannot veer from the course. I think we have to realize that we do need some guidance and direction from central administration but we have to allow a lot of those strategies to emerge. I think there are things that people call strategies now which in fact are really just their recognizing things that have happened over the past three to four years which never started out as a strategy. This relates to the earlier quote of remembering the past because there is much we have already done which will help us through this next decade.

I had occasion to go to the Snowmass Conference in August and I was impressed by a talk given by Milton Glick, Provost at Iowa State. Dr. Glick said that the "bleeding edge is not necessarily the cutting edge, it is the result of the pruning of the trailing edge". I think there is something here in terms of strategic planning. Hopefully, strategic planning is the key tool to help us protect against pruning the cutting edges as well.

Thank you very much.

BUILD OR BUY DECISION VARIABLES --PERSPECTIVES FROM THREE INSTITUTIONS

PROLOGUE

WHAT ARE SOME OPTIONS

THE PENN STATE EXPERIENCE

THE SOUTH DAKOTA EXPERIENCE

THE CARNEGIE MELLON EXPERIENCE

"BUILD OR BUY" CHECKLIST

EPILOGUE

Presented by

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PROLOGUE

In the mid-1970's, David B. Tyack wrote a "History of American Urban Education" in his Harvard University Press book entitled *The One Best System*. The book is "an interpretive history of the organizational revolution...in American schooling." The title countersinks one of the themes i.e. the search for and the definition of "the one best system," in this case the one best system of education. The "system," if you will, is different depending on your view and your role in it. Tyack uses "the swing in the tree model" to show the different views of the system and the various interpretations based on those views. Tyack's model of the differing system views should not be lost in the interpretation and understanding of decisions taken and decision variables utilized in the definition and selection of the right software to satisfy institutional needs.

Tyack's participants in system definition, design, and installation are: teachers, principals, "central office," the board of education, the maintenance department, and the students. Tyack maintains that in education, "the search for the one best system has ill-served the pluralistic character of American society." While the character of University administration and management may not be as pluralistic as American society as a whole, its goals, objectives, understanding of needs and evaluation of alternative solutions to problems are likely, far from singular.

When Universities attempt to define information and data system problems and to specify solutions to those problems, just as with education, many participants become involved. The participants each have their own view and role related to these systems: Students, faculty, administrators, executives, Boards, and staff personnel. Over the past 20 years, the data processing specialist has emerged as a serious and equal participant with her(his) own view and role of "the system."

Part of what dictates a particular solution to a given problem arises out of the different roles and views. Many of the deciding factors or decision variables exist because of these differences in role and view. In the three institutional examples in this paper, each participant or homogeneous group of participants are shown to contribute in unique ways to the decision and to the "deciding factors."

In all three cases, the students and to a lesser degree the faculty have been isolated from the problem definition and even from the analysis of solution alternatives. The primary participants in all three cases were: academic administrators, executives, staff personnel, and the data processing specialist. In one case, South Dakota, the Board of Regents also played a key participatory role and had definite views about the system it would ultimately fund.

The decision to build or buy, then, is tempered and influenced by the view and role of each of the participants. Without attribution of blame or credit, suffice to imply that the participants arrive at their respective decisions based on the role they are asked to play in the decision and the views they embrace based on previous encounters of a similar kind. The options in selection of software to help run and operate the institution are not infinite. The options are relatively few; so what are some of those options?

WHAT ARE SOME OPTIONS?

The three institutional cases presented in this paper represent many of the possible build or buy options available to institutions. These options represent real alternatives which should, at minimum, be acknowledged by any institution contemplating implementation of new or replacement application software. Table 1 summarizes different options available.

TABLE 1
OPTIONS (AVAILABLE) FOR IMPLEMENTATION OF APPLICATION SOFTWARE

Build Options	Buy Options
•Use 100% in-house staff (management and technical) •Use contract programming with in-house management •Use contract management with in-house programming •Use 100% contract staff (management and technical)	•Install "Vanilla"; change internal procedures and policies to match software •Install "Vanilla"; institution modifies to match needs •Install "Vanilla"; vendor modifies to match needs •Contract for customization before installation •Contract for source code access to perform customization under contract with vendor or by institution

THE PENNSYLVANIA STATE UNIVERSITY EXPERIENCE (PSU)

History of Systems Activities (Pre-1980)

In the late 1960's a forward-thinking president, Dr. Eric Walker, foresaw the need for integrated data and information and encouraged the formation of an organization called Management Information Systems. The MIS group developed system requirements and built some applications which increased the efficiency of student registration and grade processing. That the initial vision of a large integrated database, however,was not supported by existing technology, and efforts to create such a system.

The vision persisted. As mainframe, programming language and storage technologies improved during the 1970s the potential for integrated databases and applications reappeared. In 1979 a task force of seven senior technologists drawn from various units throughout the University were brought together and charged to:

- evaluate existing data systems, and
- recommend steps to migrate to the next levels of information technology needed to support the institution in the 1980s and beyond.

The group recommended that the University define and build a set of integrated administrative information systems, with initial implementation efforts focused on a new student information system. The group also suggested that the University contract with an outside vendor to complete the defined tasks.

The Role and Importance of the Request for Proposal.

A Request for Proposal (RFP) was written and distributed to vendors during 1981. It served several purposes. The RFP:

- articulated the need for administrative units to support an environment in which consistently defined, collected, stored and retrieved data and information are shared.
- clearly defined the expectations of the University with regard to vendor inquiries, responses and qualifications, as well as the legal rights and responsibilities of both the University and the vendors.
- permitted vendors to bid on hardware, software, or both.
- stated general requirements for software systems.
- identified hardware requirements.
- required that the following major systems were to be defined by the vendor: Student, Facilities/Property Inventory, Financial, Human Resources, Budget Operation and Planning, and Business.
- required that the student system was to be designed developed and implemented by the winning software system vendor.

The EDS Student System Decision - 1981

Proposals were submitted by twenty-two vendors. Electronic Data Systems (EDS) Corporation of Dallas, Texas, won the software systems contract. EDS did not have off-the-shelf software to meet the University's requirements, and proposed to design, build and implement a Student system. EDS also proposed the design the other five major systems using the data flow diagram approach defined by Yourdon. The University decided to provide the hardware system using internal resources.

The Database Management System - 1981

A joint EDS-University team was formed to select the database management system, the teleprocessing system and the application software to be used in the development and implementation of the Student system. The team selected ADABAS, COM-PLETE and the fourth generation programming language NATURAL developed and marketed by Software AG, Inc.

The Evaluation of the EDS System - 1990

EDS turned over their final Student system products during 1985. The system which they turned over featured many on-line screens and many batch procedures. There is some real difficulty in looking at today's system and relating it to the EDS products. Many of the EDS products were functionally inadequate. An in-house staff of twenty-four analysts and programmers worked for three years after EDS departed to bring the products up to an acceptable level of performance and utility. Additional functions beyond the EDS products have been added, including a transcript system and a degree audit system. New technology such as voice response capabilities are now playing a major role in the processing of student registration and drop/add data. Those technologies were not required of nor included in the EDS development. The student system is no longer an EDS product. But that position does not minimize the significant contribution which EDS made to Penn State. Looking back on the decision to proceed with the EDS contract there were many positive benefits gained by that decision.

- The decision to hire an outside contractor established the necessary resources to launch the University into the on-line database era. Their presence within the University forced central offices and end users to realize that they had to be intensely involved with system design, testing and implementation.
- The fact that the vendor was working on a tight time-line required active University commitment of resources when the vendor needed them. No unnecessary delays could be tolerated on the part of the University because ". . . the meter was running".
- The vendor brought expertise in state-of-the-art systems definition and design methodology which was not available within the University.
- EDS and the University's senior technologists jointly established an expectation that data would be available to end users for ad hoc analysis and reporting. The environment for data administration was successfully established as a result.

Other factors which affected the pace and direction of the contract included the following:

- EDS had no previous experience in developing systems for higher education. They envisioned the Penn State contract as the first of many in higher education, and assumed that some of the products developed for Penn State would be transferable to other institutions. In effect the University was a complex training ground for EDS staff to learn about higher education while they were analyzing and developing systems to support the environment.
- The University had no previous experience with the level of system effort being undertaken, and did not realize the commitment of *senior* resources needed to interact with the vendor.
- The University needed to learn "on the fly" how to manage the process. Staff networks were needed to establish security access for users of the new Student system. Other University departmental resources were assigned to act as trainers in the "train-the-trainer" environment.
- Training users of the system was made difficult because vendor resources were very limited to support the on-going training needs as new products were developed and

released. EDS provided systems development personnel, not professional trainers or instructional development personnel.

- EDS underestimated the resource requirements.
- EDS had no prior experience using the ADABAS database management software and the NATURAL programming language selected by the joint EDS-University team.

The University received most of the basic modules of the student system which had been promised; the EDS product gave the University a base on which to add and to enhance.

The Integrated Business Information System (IBIS) Decision - 1987

Following the Student System development experience the University evaluated the EDS process and products and determined that sufficient expertise regarding the system development and implementation process existed so that the University should proceed with the development of IBIS using internal resources. It was decided that resources would come from many central administrative organizations, not just central data processing. Thus IBIS development began with staff from many offices all ready supporting the business functions of the University. Leadership drawn from user organizations was assigned to manage priority setting, and play a significant role in assuring that sufficient resources were available to keep the project moving forward successfully and on schedule.

Comparison of the Two Approaches

The two approaches can be compared only when the environment, and staff knowledge and experience at the time of the decision are carefully taken into account.

The decision to go with an outside vendor was based on several factors which applied in 1980:

- University technical staff were heavily enmeshed in the maintenance of existing systems, and organizing a critical mass of staff to complete such a major undertaking was deemed impractical.
- University administration had recognized that much improved information systems were needed for the University to be successful in the 1980's and beyond, and were willing to commit financial resources to make that happen over a relatively short time horizon;
- University staff had limited knowledge at best of new analytical techniques which could be ffective in the major systems development environment being envisioned;
- University staff had limited knowledge about the development of on-line systems in the relational database environment, but were willing to learn by working side by side with a vendor who could apply those techniques.

By 1987 much of the technical data processing environment of the University had undergone the changes envisioned in 1980. The following factors led to the decision to develop the remaining systems in-house:

- University staff had acquired significant expertise in the development of products for the on-line environment;
- User offices were committed to the concept that they had a significant role to play in defining system functionality and in cooperatively developing and implementing applications critical to operations and planning within the University;
- There was a feeling of commitment which said to the University community that existing staff were up to the task ahead, and that those staff, because of their in depth knowledge of University environment and functions, could do a better job than an outside contractor.
- There was a realization that the system development effort would require the assignment of significant numbers of University resources, even if an outside contractor was brought in to do the job.
- It was felt that in-house staff could improve significantly on training previously provided because of their understanding of the operational and planning processes used within the University.

Decision Variables Important to the Selected Approach

The above comments can be condensed into the identification of the following variables which appear critical to any decision on "buy versus build":

- The current workload of existing staff with regard to maintenance of existing systems;
- Staff knowledge with regard to analytical techniques used to define the functionality of a system;
- the commitment of the institution to funding a vendor effort versus an in-house effort;
- The availability of a vendor-supplied software package which could meet the majority of the institution's needs without needing overwhelming enhancements or modifications (significant enhancement could equate to little or no vendor maintenance of the operational system);
- The availability of a vendor package which could run on the existing hardware and database platform, and using application software which existing staff were familiar.
- The availability of management expertise within the institution to control development and implementation in either the vendor or in-house environment.

THE SOUTH DAKOTA UNIVERSITIES EXPERIENCE

History (Pre-1984)

There are six public institutions under the control of the South Dakota Board of Regents: Black Hills State University (BHSU), Dakota State University (DSU), Northern State University (NSU), South Dakota School of Mines and Technology (SDSMT), South Dakota State University (SDSU), and the University of South Dakota (USD). These Universities operate autonomous academic programs and each has their own president and administrative staff. The institutions are all located near the states bordering South Dakota.

Prior to 1984 each of the institutions maintained and operated separate, distinct administrative data systems. There were three mainframe computers being used in support of these systems. SDMT utilized a CDC Cyber system, SDSU operated an IBM 370 class mainframe (3031) and another IBM 370 class mainframe (3033) was located at USD. BHSU, NSU, and DSU utilized the 3033 located at USD through remote job entry stations. Each of these institutions wrote and maintained their own applications even though they shared a common hardware resource. The one exception was payroll processing. The payroll system which was utilized by USD, BHSU, NSU, and DSU was maintained by USD staff. The production was run by each of the institutions.

The shared facility at USD was referred to as the Higher Education Computing System (HECS). The HECS facility was managed by the USD computing center staff. There was not a *separately*, defined (or budgeted) HECS and USD Staff. There was however, a separate budget which was used for HECS hardware and system software acquisitions.

The Role and Importance of the RFP Process

In 1984 the South Dakota (Higher Education) Board of Regents mandated that the six institutions move to a centralized on-line registration and student information system. The goal of the Board was to have more centralized and standardized reporting capabilities in terms of data and format. Several of the institutions had developed their own on-line registration systems but registration was still a batch process at a few of the institutions. A state-wide task force was formed and charged with producing a functional requirements document for the system. This task force had representation from each of the six institutions involving a large number of people who contributed to the creation of and official Board (document describing and delineative the requirements.

The requirements document was submitted to many commercial vendors for proposals and responses. Several vendors made presentations to the task force. Existing systems at several of the S.D. institutions as well as a couple of other institutions were also evaluated against the functional requirements. The possibility of "in-house" development of the new student system was also evaluated; there was not a central information systems staff in place at that time. The effort required to assemble a staff and build the application from scratch was considered too vast for serious consideration. The effort could not be completed within the prescribed time frame. The Board was anxious to replace the existing, disparate systems and wanted a solution within 2 - 3 years.

Evaluation of SIS Decision

The number of vendors in contention was reduced to two . . . Information Associates and SCT. Detailed proposals for systems which would meet Board requirements were solicited from the vendors. Both proposals required a significant amount of modifications to handle multiple institutions and to meet other specific S.D. requirements. After extensive, competitive evaluation the task force recommended the purchase of the SCT ISIS system. Even though South Dakota state law did not require a formal bidding process for the procurement of software and services bids were extremely cost-competitive. The final decision was preceded by software testing, technical demonstrations and an intense review of the finalists, business qualifications.

The decision to purchase the SCT system rather than build a system from scratch still appears to have been the correct decision. The system is up and in production. Like all implementations there have been problems along the way and there is still a list of outstanding requests. The political environment was one in which it was much easier to obtain funding to purchase software and services than it was to obtain the same amount of funding for the staff necessary to undertake the writing of a system of this magnitude. Furthermore, a development project of the perceived magnitude and size had never been successfully undertaken in South Dakota at that time.

Payroll/Personnel Decision

The Board of Regents also decided that the institutions should be using a common payroll/personnel system. There was considerable political pressure for the institutions to "join" the state government payroll system. The State of South Dakota system did not provide all of the necessary functionality required by higher education. Vendor systems were evaluated during this process. There were no vendor products available which supported multiple institutions *and* provided the required functionality. There was a central HECS staff at this time and a product existed that was already being used by four of the six institutions. The product provided a substantial beginning compared to building a system from scratch.

The decision was made to use the "PayPerS" system and make the modifications necessary to support the two additional institutions. The changes necessary to support the other institutions were identified and the modifications made to the system by the HECS staff. A state-wide task force was once again formed with representation from each institution. This task force identified system functionality and recommended priorities for system enhancements and modifications. There was very little incremental cost involved in this approach. The base software already existed and the modifications were relatively minor.

Comparison of the Two Approaches

The two approaches both have worked fairly well. The alternatives, however, were very different in the two situations; for example:

- There was no common applications platform at the six institutions to use as a starting point for the SIS but one did exist for the Payroll system.
- There was a much greater difference among the institutions in operations, procedures and requirements for the SIS than for the payroll (PAYPERS) system.
- The modifications to the SIS were performed by the vendor. The cost of the modifications exceeded the cost of the license for the base product; fewer modifications to the PAYPERS were required.
- There was an applications development staff available to perform the modifications to the PAYPERS system; staff was not available at the time the SIS decision was made.
- Even though the South Dakota higher education funding was austere, it was much easier (in a relative sense) to obtain software funding than to hire new personnel.

THE CARNEGIE MELLON UNIVERSITY (CMU) EXPERIENCE

History of Administrative Information Systems (1986-1987)

The opportunity to implement a new generation of administrative information and management support systems was made possible in 1987 by the allocation of permanent University funds for this express purpose. The *confluence* of recognition of need by the senior officers of the University and the opportunities provided by the current and near future technologies have provided the new model for the acquisition and processing of data and its transformation into useful business information and intelligence.

The systems development leverage provided by the merging of relational data base systems with open systems architecture will negate the need to reprogram when new hardware or operating systems are dictated. The long term financial and operational advantage of application tenure cannot be overstated. Current indications are that many application software vendors agree and are planning or are creating more portable applications. In 1986 when the Carnegie Mellon Administrative Systems strategy and technological vision was articulated, few applications vendors had yet seriously acknowledged products based on either relational or open (systems) hardware and operating system platforms. Carnegie Mellon did seek out and find a few vendors who were willing to experiment with relational applications. Technology opportunities have dictated the course of administrative systems development in equal partnership with the changing demands of both the central and non-central offices of the University.

The Role and Importance of the Requirements Process

In anticipation of the removal of the DEC-20 computing environment, two major administrative systems development projects were authorized in 1986. These two projects were:

- *Student Information Systems (SIS)* consisting of new applications software to serve the functions of admissions, student record-keeping and registration, financial aid, student accounts receivable, student housing, and dining services.
- *Human Resource Information Systems (HRIS)* consisting of new applications software to serve the functions of personnel and benefit administration, payroll, wage and salary administration and manpower planning and budgeting.

While the Administrative Systems department was responsible for the development or installation and implementation of each of these applications, the system requirements and the selection from design alternatives were the responsibility of a broad base of administrative and academic offices. The process of requirement definition, planning, review of policy issues, establishment of project time tables and identification of costs associated with these projects began with the creation of a three-tiered organizational structure. The structure provided for:

- *an Executive Steering Committee (ESC)* whose general responsibilities are to provide University policy guidance and resolution, approve cost proposals and resource commitments, negotiate contracts with outside vendors, review project plans, monitor progress and approve "build or buy" decisions.
- *two Planning Task Forces (PTF),* one for HRIS and one foe SIS, whose responsibilities were to develop the project implementation plan, set timetables for completion, select software, recommend to build or buy applications software, monitor implementation progress, develop cost proposals and develop system design specifications.
- *two Implemention Task Forces (ITF),* one for HRIS and one for SIS, whose responsibilities were to install and/or develop application software, write or rewrite system and procedure documentation, design forms, provide detailed design and/or modification specifications, effect modification, write any new application code, test programs, modules, and systems, convert necessary input files, monitors tests and conducts any parallel (old system and new system) runs.

These three organizations drew upon personnel resources from many departments were completely responsible for all phases of the systems development process. The two planning task forces with assistance from a consultant developed the functional requirements against which the "Build or Buy" decisions were evaluated. Vendors were contacted for interest and qualification assessment; there was no formal request-for-proposal developed. Each vendor reviewed their products with the PTF and in most cases provided at least minimal product demonstration. The single most important result of the requirements process was the opportunity for each "participant" to share their view of the desired system with all other participants.

The Database Management Decision - 1986

While some Universities moved to data base applications in the late 60's and early to mid-70's, Carnegie Mellon chose to develop applications where programs and data were inextricable intertwined and file and data structures were relatively straightforward. The efficiency of relational technology in intense transaction-oriented applications was somewhat suspect. With the rapidly decreasing price-to-performance of processors and memory, inefficiency appeared to be less of a concern. Carnegie Mellon with the assistance of IBM, DEC and RTI (INGRES Corporation) conducted extensive benchmarks of the INGRES DBMS; the results were extremely favorable.

The decision to select INGRES was strategic in that (the decision) would seriously affect the future of administrative applications and the hardware platforms on which those applications would operate. There were no vendor supplied INGRES based applications available for higher education in 1986. Therefore, a decision to implement new applications using INGRES as the RDBMS was a de facto decision to develop many new systems in-house. The timeframe constraints on the other hand dictated that some software would need to be purchased and only a portion of the applications would be built "in-house" from design to implementation to use.

The SIS, HRIS and Alumni Information System Decisions

By executive mandate, all existing administrative applications were to be moved from the existing DEC-20 by December 31, 1988. This movement was to be accomplished by:

- *conversion* of non-integrated administrative DEC-20 applications to the microcomputer regime both stand-alone and networked.
- *conversion* of some applications to the VAX-VMS regime such as the University's financial accounting system (General Ledger and Accounts Payable). The planning for this move was begun in 1986; the move would take place after the 1987-88 fiscal year end closing (circa August, 1988).
- *replacement* of the key, major applications through both joint development partnerships and in-house development. Implementation of a student aid management system in partnership with SIGMA Corporation was undertaken and implemented in February, 1988 on the VAX 8700. Other applications identified for replacement were: Student Records System, Human Resource System (Payroll and Personnel) and Student Account Receivable. Two other major systems slated forreplacement at that time were: Alumni/Development and Admissions.
- *joint definition and articulation of information systems requirements* by central and non-central offices. Key departments work closely with the Administrative Systems department to ensure that proposed replacement systems meet non-central as well as central data and information system needs. The result of the implementation of administrative systems was to provide the basis for distributed data bases as well as distribution of processing and computing.

Evaluation of the Decisions - 1990

First, what were the decisions? CMU decided to replace all of its administrative applications either by conversion (to another operating system/hardware platform) with minimal enhancement or by developing new applications to replace old systems or by buying software from vendors willing to consider minimal pricing in return for a resultant product which would interface with the INGRES relational data base. The compelling forces leading up to these decisions were:

- Elimination of the existing hardware platform.
- Austere funding strategy given the scope of the replacement requirements.
- Minimum time frame to complete replacement of all applications.
- Desire by key administrative users to enhance rather than simply replace applications
- Migration to more portable, platform-independent applications.

Table 2 outlines the selected implementation strategy for each (major) application that has been replaced and also shows estimates of resources consumed by each of the applications. Table 3 assesses the decisions which were taken based on a retrospective (1987) assessment and a 1990 assessment of the 1986-87 decisions.

From these two tables one could conclude the following:

- The cost differential in personnel resources between "build and "buy" has been minimal.
- The cost differential swings both ways.
- There is less dissidence between user expectation and user satisfaction for smaller systems.
- The more involved the users are in the "build" or "buy" decision, the more likely the user will be favorably disposed toward the decision--whatever it is.
- The converse is also true; i.e. the less the users are involved the less supportive they will be.

TABLE 2
IMPLEMENTATION STRATEGY, BY APPLICATION

Application	Implementation	Staff Effort (person/yrs.)
1. General/Ledger/Accounts Payable (GL/AP)	Conversion	1.5
2. Payroll/Personnel (HRIS)	Buy/Modify Software	3.0
	Develop InHouse	6.0
3. Student Records (SIS) (including Student Accounts Receivable)	Develop InHouse	8.0
4. Admissions (SIS)	Develop InHouse	5.0
5. Financial Aid (SAMS)	Buy/Modify	3.0
6. Alumni System (AIS)	Buy/Modify	8.0
7. Property Management/Fixed Asset (PMIS)	Develop InHouse	2.0
8. University Information System (UIS)	Develop InHouse	5.0
9. Career Services and Placement (CSP)	Develop InHouse	2.0
10. Applicant Tracking System (CMARS)	Develop InHouse	1.0
11. Financial Resource Information System (FRIS)	Develop InHouse	1.0
12. Degree Audit (AA)	Buy/Modify Software	0.5
13. Room Scheduling (S-25)	Buy/Modify Software	1.0

TABLE 3
ASSESSMENT OF SELECTED "BUILD OR BUY" DECISIONS
(BASED ON PROBABLE USER: VIEW)

Application (Decision)	1987 Assessment	1990 Assessment
1. GL/AP (convert)	1	3
2. HRIS (buy/build)	1/1	2/1
3. SIS--Student Records (build)	1	1
4. SIS--Admissions (build)	1	1
5. SAMS (buy)	3	2
6. AIS (buy)	1	3
7. PMIS (build)	2	1
8. UIS (build)	3	1
9. CSP (build)	3	1
10. CMARS (build)	1	1
11. FRIS (build)	3	1
12. AA (buy)	1	1
13. S-25 (buy)	1	1

LEGEND: 1 = GOOD DECISION; 2 = BAD DECISION; 3 = TOSS-UP

BUILD OR BUY CHECKLIST

The three cases exhibit many of the same properties critical to the decision to buy or build. While of the decision variables on this checklist apply to all three institutional settings some applied more specifically to 1 or 2 of the settings.

- The (current) workload of data processing staff with regard to maintenance of existing systems.---(All)
- Staff knowledge with regard to analytical techniques used to define the functionality of a system.---(All)
- The willingness of the institution to funding a vendor effort versus an in-house effort.---(All)
- The availability of a vendor-supplied software package which could meet the majority of the institution's needs without needing overwhelming enhancements or modifications.---(All)
- The availability of a vendor package which could run on the existing hardware and database platform, and using application software with which existing staff were familiar.---(PSU and SDU)
- The availability of project management expertise within the institution to control development and implementation in either the vendor or in-house environment.---(All)
- Availability of multiple viable vendor alternatives which fit the hardware and software environment.---(All)
- Availability of data processing staff resources for development in-house.---(All)

- Cost of software plus cost of vendor-supplied modifications vs. cost of personnel to design, develop, test, install and place in production the functionally correct software.---(SDU)
- Acquisition policy and funding philosophy for each institution or system of institutions i.e. additional resources for people, software or vendor-supplied personnel? Which is more viable in your environment?---(SDU and CMU)
- Access to and availability of technical staff to develop new applications---(All)
- Portability of Applications to Future Hardware and Operating Systems.---(CMU)
- State-of-the-Market-Technology.---(All)
- Vision from the top of the Organization---(All)

EPILOGUE

The three institutional examples of decisions considered and decisions taken exhibit similar decision variables. This is, to us a least, very surprising, given the extremely different cultural and governance differences. Penn State on the one hand operates 22 campuses as a very large, state land grant institution in a rural setting under strong central office control. South Dakota's state supported universities are wide-spread across a state covering 75% more land area than Pennsylvania which operate six autonomous academic programs under strong central oversight from the Board of Regents. Carnegie Mellon is a small private, urban research University which operates with only modest goverance from its Board of Trustees and has seven academic schools within its purview, all quite autonomous academically.

And yet, the decision to "build or buy" in each instance seems inextricably intertwined with a very similar set of decision variables across the three cases. On the other hand, the decisions taken are not only different across these institutions but different from application to application. The answer is clear. There is no one best answer, at all times, for all time, in all places. The answer is -- It all depends ! ! "

The "answers" seem to depend on:

- the users' views of "the system"
- the users" role in selecting "the system"
- the credibility of the:
  - in-house developers
  - available vendors
- the match between vendor software and campus technology vision
- the enhancement requirements of vendor software
- involvement of executive decision-makers (this one is tried and true)
- funding policy limitations

The "answers" seem to depend less on:

- the initial perceptions of software requirements vs. software availability.
- the total cost of either implementation.
- what vendors say their software can do and more, the actual performance
- the initial investment cost of the either.

Bootstrapping a Small Campus into the Electronic Age

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A fifteen hundred student campus has launched a process to bring itself from a state of almost no use of technology to a respectable level within a six year period. The process has included introspection, external review and U. S. Dept. of Education Title III funding. Careful attention has been given to faculty development, planning, and organizational structure. The technology includes Local Area Networking, distance education through interactive television, library automation, interactive video and traditional audio-visual.

The presentation will cover strategic planning, current status and future expectations.

In this paper we give a thumb-nail description of the University of Maine at Presque Isle, a brief history of technological events through fall of 1988, a statement of the crisis at that point and the steps taken from that point to resolve the situation and propel progress.

I. Description of The University of Maine at Presque Isle

The University of Maine at Presque Isle (UMPI) is the fourth largest of seven campuses of the University of Maine System. It has evolved from a Normal School and Teachers College and in 1969 assumed its place in the new University of Maine System. Within a few years it increased its size of student body and faculty, and diversified its offerings. Its strongest programs today are in elementary and secondary teacher education, business, social science, physical education and recreation. There are also several modest liberal arts programs. Approximately sixty-five full time faculty over four divisions together with thirty-five part-time faculty serve programs on campus and at off campus centers located at Loring Air Force Base (LAFB) and the town of Houlton ME, 20 and 40 miles respectively from Presque Isle. The three dormitories on campus hold four-hundred students. The full time equivalent enrollment is 1000, with approximately half of all students over age 24 or having children of their own.

II. History of Technological Events through Fall 1988

This history is characterized by erratic resources, and subsequent chaotic development.

Academic computing has evolved from the installation in 1969 of one IBM 2741 terminal to the main-frame in Orono 150 miles to the south and then another in 1972. In 1981 four Apple II+ microcomputers were bought, and in 1982 a one-quarter time Coordinator of Academic Computing Services (ACS) was appointed from the faculty. By 1984 the four Apples had become eight and a third terminal to the main-frame was added.

In early 1984 a first Five Year Plan for ACS was drawn up by the quarter-time ACS Coordinator. At that time, no networking was considered, and a steady acquisition of microcomputers and terminals was anticipated. Envisioned were limited dormitory access to microcomputers and the University System supported mainframe computer in Orono called CAPS (Computing And data Processing Services), a manual software check-out system, a shared microcomputer in each faculty office complex (each serving approx five faculty), an expanded open computer lab, a closed computer lab for ongoing faculty and student projects, a computer for each instructional laboratory (e.g. chemistry, physics, biology physiology) and provision for several classrooms equipped for group viewing of a computer monitor. A goal was set to have one accessible computer keyboard per four faculty and one per 25 students. It was anticipated that the computer coordinator would become at least one-half time and that half-time clerical support would be sufficient. All on-site maintenance would be performed by the ACS Coordinator.

In late 1984 a bond issue was passed by the public in the state which included a large component for upgrading technology, and in particular networking as it was then conceived. Using this funding, by early 1986 an AT&T Integrated Systems Network (ISN) was installed on campus. This is a telephone style packet switch which handles data at serial speed. The ISN provided access to local minicomputers, the CAPS mainframe including E-mail, shared printing capability, and the planned on-line Library Automation system. Also, additional IBM compatible microcomputers were purchased, our first run of fiber-optic cable and quantities of four-pair copper wiring to individual faculty offices and student stations were installed.

A second state bond issue in late 1986 provided another small jolt of funding with which we purchased additional PC's, more copper wiring, expansion of the ISN and another run of fiber-optic cable.

In 1986, the ACS Coordinator position was still one-quarter of a faculty member's load and a new full time position was established, that of Manager of ACS. This professional staff position reported to the ACS Coordinator and handled hardware and software installation and maintenance, work-study supervision, user services of all kinds, and hardware and software product and vendor recommendations. Clerical support was supplied as a portion of the responsibility of a Division Secretary. Approximately sixty hours of work-study time were required each week to keep the ACS facility fully functional.

In the realm of Distance Education, in October 1986 U. S. Dept. of Education Title III funding was received for a three year project to establish a two-way-television system connecting the campus with the two off-campus centers. This was intended to enhance programs at those locations through increased involvement of regular full-time faculty and increased course and program offerings. This was accomplished through a microwave link to LAFB and a fiber link to Houlton. This system began operation in the fall of 1988 and began administratively and budgetarily under soft money.

The department of media services had been physically moved to the basement of the Library and Learning Resources Center when it was constructed in 1975 and was organizationally under the director of this facility. It has traditionally consisted of approximately 1.5 full time equivalent professionals and heavily utilized student help. Its budget was not separate from that of the Library and was often minuscule.

III. Status in Fall 88

Personnel

At this time there was a one-quarter time Coordinator, a full time Manager and a part of a Division Secretary's time devoted to Academic Computing Services. The two-way-television project had a soft-money technician, with supervision provided by a Division Chair. Media services including rudimentary television production involved one full and one part time person reporting to the Director of the Library and Learning Resources Center.

It should be mentioned here that throughout all this, the campus has kept administrative computing quite separate and under a different vice president. Most of the computing done here is mainframe based and therefor very much under the penumbra of the University System mainframe organization, CAPS. On this campus, administrative computing has been understaffed and has suffered from lack of an organized training effort and a necessary focus on day-to-day needs. The Direction of Administrative Computing is only a part of the job of the Director of Accounting. There is a part time assistant position held by various individuals which has been vacant much of the time.

Demands for Services

There were increasing demands by faculty, students and others for the services which were reasonably expected from the technological staff, particularly ACS. Recent additions to the workload included providing access to a new televised campus news bulletin service from the University Relations Office, a steadily increasing number of courses which required computer use either explicitly or implicitly, and a library automation system which includes an on-line catalog, acquisition and circulation had been established within the University System.

There has been a need for a modern student information system on this campus. The University System provides a mainframe based system. This handles traditional aspects of record keeping but has little to offer in the way of student tracking, easily accessible information for academic advising, program planning and assessment or institutional research.

Significant progress had been made by many faculty in computer literacy through self study and their own professional resources. Close to half of our faculty were aware of the uses being made of computing within their field or discipline. ACS had been unable to provide much organized training of its users, including the faculty. The ACS Manager has spent considerable time in a one-on-one basis with some faculty because they did not know the basics of the standard MS-DOS operating system or other fundamentals.

Hardware

Hardware at this time consisted of the ISN installed in 1885, and upgraded in 1987. It operated at serial speed and connected ninety-six ports including twenty-two ports on two AT&T 3B2 minicomputers, models 300 and 400.

In reference to the 1984 five year plan, the twenty computers now in use by faculty (including Division Chairs) were very close to the anticipated ratio of one to four. There were approximately twenty-four computers for student access which was about one per fifty-eight students. This was a long way from our goal of one keyboard per twenty-five or from one to about twelve maintained by some schools. The difference between our projected ratio and the actual one was due to the almost total elimination of terminals, a loss of about five machines due to failure, and a student body of 1400 as opposed to the anticipated 1200.

Other material resources included a flat-bed plotter, a few pieces of UNIX based software, miscellaneous MS-DOS and Apple II software, an LCD overhead projection panel, and several printers and switch boxes.

Facilities

One of our three dormitories now had two microcomputers, one of which was purchased partially with student raised funds, with no software and no access to CAPS. The Library had three microcomputers for public use and, through these, access to the network.

Software distribution through the library or other centers had never been very successful. By 1988, software distribution had evolved dramatically due to changes in technology and availability of bond issue monies for the campus network. We were still distributing some software on floppy disks but also had a word processor and an integrated package available on the minicomputers and the Information Systems Network. Unfortunately the system could handle only about twelve to fifteen simultaneous users, which severely limited its effectiveness when an entire class was on-line.

The concept of central computers for groups of faculty quickly gave way to individually operated machines. The network reached into each faculty office providing access to the minicomputers, to CAPS and electronic mail. The Open Computer Lab now held seven Apple computers. This was mainly used by Education majors. The Closed Computer Lab was very different from what was anticipated in 1984. This room now combined the features of an open lab with a classroom and was at best a compromise. Most of the student accessible machines were here, but due to scheduling of classes and lack of attendants it was not open nearly enough. The open hours of this facility needed to approximate those of the library. We had progressed very little in providing for the instructional laboratories. One classroom had access to the network, and two large monitors were available for mobile use.

Programs

This configuration of hardware was supporting computer literacy classes, Pascal programming, two word-processing oriented composition classes, business computing classes, introduction to computing classes for Education majors and general word-processing for student use. A fledgling degree program in Academic Computing had been withdrawn. We had a very weak minor in Computer Science having little available faculty expertise or time to devote to it. The primary use of our computer facilities was for word processing, programming classes, computer literacy classes of a generic nature, as well as for various specialties such as business and education, and other various computer supported instruction.

All student accessible machines were on campus and none at the off-campus Centers. WordPerfect, Smartware and a Pascal compiler were available on the AT&T minicomputers. Business students were using software accompanying their texts, and what Apple software we had was manually distributed.

Budget

The annual ACS operating budget had been $8500 for several years. A widely used method of determining annual replacement and maintenance costs on this type of equipment is to take 10% of the value of the equipment. This does not allow for any expansion or upgrading of equipment or services. The past two bond issues for the University of Maine System had provided somewhat more than $200,000 in computing equipment at Presque Isle. If we ignored any equipment on hand before 1985 this indicated that our maintenance budget should have been in excess of $20,000 per year. We had about $8,800 of outstanding requests from faculty for computing equipment and support software. The only equipment on which we had maintenance contracts were the two mini-computers. While it would not have been cost effective to put many of the items on such a contract, it would have been reassuring to have the Information Systems Network on such a contract as we were growing ever more dependent on it.

IV. Introspection

ACS was facing a personnel and budget crisis. The campus budget allotment for the academic year was estimated to be adequate to support operations to a minimum level only till the end of the first semester. Requests for services far exceeded our ability to respond. We were frequently experiencing equipment failure and damage due to inadequate lightening and heat protection. Each failure decreased the reliablilty of the system and had its cost in staff time.

A status report was prepared by the Coordinator of ACS. In this report a complete description of the current status of hardware, software, services, budget and personnel was given an analysis of the situation at that point. This document contained the information presented above and some concrete proposals. These included: increased staff, hard-drives and software for dormitory computers, meeting most urgent faculty requests for hardware and software, maintenance contracts for critical network components, additional networked machines for students in the Library, additional networking to reduce the manual software distribution, additional printers, lightening protection and strategic air conditioning.

While this document was not a new five year plan or an exhaustive study of instructional technology at University of Maine Presque Isle, it was suggested that all instructional technology should be thought of as a unit since there is so much overlap in the media, necessary skills, and space and equipment requirements. For example, conduits can carry voice, data, and video transmission media, video projection devices and monitors can enable data or video viewing. Technical skills required to construct or maintain one type of equipment are transferrable to other types, management of equipment and equipment access and distribution issues have similarities in all areas, and equipment from each area can be interconnected for the enhancement of each.

V. EDUCOM Consultant

Two important results of the above introspective status report of the fall of 1988 included additional one-time budget money to address several of the specific immediate needs.

A more significant result was support from the Academic Vice President to select and hire a consultant for the entire academic technology area. Since the area was seen to extend over media services, interactive television, academic computing, library automation and student information systems it was necessary to favor some areas over others in the selection of a consultant. Because our distance learning project seemed comparatively more mature and the other areas were more minor in scope we favored ACS and selected the EDUCOM Consultants Bureau. Dr. Larry Bielawski, Director of Academic Computing at Goucher College spent two days on campus and talked with over fifty individuals representing students, faculty and staff on various technological application aspects. This resulted in a comprehensive report which focused on five specific areas of need:

1) Lack of a clearly articulated vision or goal for UMPI'S educational technology program.

2) Ineffective management of diverse areas of instructional technology as a result of no central office charged with overseeing technology development and implementation.

3) Poor space allocation and access to educational technology, leading to inequitable resource distribution and lack of programmatic impact.

4) Severe budget constraints causing maintenance and upgrading problems to the point of program degradation.

5) Inability to take advantage of newer, more-capable technologies, including networking hardware.

Several fairly specific suggestions were made to address these areas of need which were incorporated into the project described below.

When the report of the consultant was received, the campus was in the process of writing an application for a new $600,000 Title III grant for the next three years and focusing on the areas of student assessment, advising, tracking, and retention. A second and related activity involved the establishment of a Learning Center with new positions of Director and Writing Specialist. With the EDUCOM Consultant's report in hand, the application was expanded to a $2.5 million five year project with heavy emphasis on the establishment of an Office of Educational Technology and cooperative arrangements with the other two activities. This expanded project received U. S. Department of Education funding starting in October of 1989.

VI. Title III project

A major thrust of this project is to upgrade information technology services to the institution over the five year period from October 1989 through September 1994. In particular, the following are in progress:

* An office of Educational Technology has been established under the Academic Vice President. This office consolidates the functions of ACS, Instructional Television, Media services, Library Automation, and Student Information for tracking, advising, and program review. The consolidation involves the sharing of maintenance, purchasing, personnel and training.

The office staff consists of a Director, Administrative Assistant, Manager of Academic Computing Services, User Services Specialist, Manager of Instructional Television Services, Instructional Designer, Coordinator of Media Services and Television Production, and a Data Specialist.

* A program of faculty and staff professional development opportunities has been instituted. This provides funds for travel, workshops, and software to enhance classes, research and programs.

* All faculty who have a need for computer resources are provided with basic equipment, software and appropriate training, for increased productivity in teaching, research, and data collection.

* A maintenance facility has been equipped with diagnostic equipment, tools and spare parts. All computer, television and media related equipment has been recently inspected and inventoried. An appropriate program of preventative maintenance will be established for each type of equipment.

* Assist in the design and equipping of the University Learning Center Laboratory which is developing under another activity of the grant. The Center is to incorporate the use of microcomputers for computer assisted instruction, including the use of word processing as a learning tool. A twenty machine networked lab will be dedicated to developmental instruction and student assessment.

In future years the Title III project will enable the following activities:

* A satellite down-link interconnected with all other video networking services and instructional services.

* Enhanced video production capabilities through additional hardware, staff training and increased staff.

* Improved instructional design services through capabilities of desk-top publishing and graphics production.

* Increased exposure of Education majors to the uses of computer technology in the public school through additional equipment, software and curriculum revision.

* Enhanced the broadcasting curriculum through an audio production facility.

* Enhanced science instruction through use of interactive video-disk and camera equipped microscopes.

* A computer and software purchase program for students, faculty and staff.

* A 10 megabit campus local area network to bring software,

printing resources, CAPS, INTERNET, library automation, student information, and other services to all appropriate buildings on campus.

* Upgraded student computer accessibility at off campus Centers through networked equipment, similar to that on campus.

* Improved access to reference material and indexes by installation of CD-ROM services in library and on the network.

* An easily accessible comprehensive Student Information Database for faculty and staff to assist with student tracking, advising and assessment of college programs.

The two way television system connecting the campus with its two off campus Centers has been operating since the fall of 1988 with an increasing schedule of classes and is currently offering approximately eight classes each semester. A state and federally funded statewide interactive television system has been operating since the fall of 1989. Both of these systems are administered by the Office of Educational Technology and are thoroughly integrated into all its activities.

The synergy created through the existence of the office has begun other initiatives not anticipated explicitly at the start of the project. Among these are the establishment of a facility which combines a second interactive television classroom, interactive conference capability and media presentation room. This has been accomplished through cooperation with the extensive statewide interactive television project and several other on and off campus entities. Data signals now piggy-back on television signals to off campus Centers. Negotiations with a local cable company will result in mutually beneficial projects, including the enhancement of a campus channel. Art faculty are actively planning the first of a proposed sequence of television production courses. Cooperation with the institutional research office has opened new avenues of potential for a strategic management system to include the already planned student information system.

VII. New Directions

Areas which are certainly related are inter-and intra-campus voice communication, electronic laboratory equipment, and campus radio broadcast and production facilities. There are also areas of activity which are technological and allied with the above but which are not instructional in nature. These include administrative computing, and some of the voice and data communication. Although there has always been a cordial relationship with administrative computing on campus there has never been formal or structured cooperation. A three person coordinating team consisting of the Director of Educational

Technology, the Director of Administrative Computing and the Director of Institutional Research is to be established and charged. This should enable further economies of scale in maintenance and training and facilitate many projects through shared information and expertise.